10 GROUNDWATER

10.1 INTRODUCTION

A groundwater impact assessment for the proposed southern CSM water supply pipeline (the proposed pipeline) from the Berwyndale South coal seam methane (CSM) gas fields (from a point adjacent to the Condamine Power Station which is located approximately 93 km south of the MLA 50230) has been undertaken.

10.2 METHODOLOGY OF ASSESSMENT

10.2.1 LEGISLATION

Water Act 2000

The *Water Act 2000* is the key piece of legislation that regulates the interference and extraction of groundwater within Queensland. The regulatory authority is the Department of Natural Resources and Water (NRW). Water management within Queensland is regulated through the development of Water Resource Plans and implementation of Resource Operations Plans. These plans provide a process to balance socio-economic and environmental needs, for managing unallocated water and defining the rules to protect dependent ecosystems and manage extraction. The Wandoan Coal Project area is located within the Surat North Management Area (20) within the Great Artesian Basin (GAB) Water Resource Plan. This Plan manages artesian groundwater within the GAB and subartesian water that recharges the GAB sediments.

The Act authorises NRW to grant licences and permits for the extraction, use and interference to the flow of water, including groundwater. All bores that 'take' water (i.e. pumped) are required to have a development permit which gives the developer authority to construct a bore and defines any conditions of extraction (i.e. maximum depth). The development permit with a designated *'works number'* replaces the need for bores to be registered (as required under superseded legislation). The licence grants a share of the resource (i.e. entitlement). A water permit allows for the extraction of water, and designates a use/purpose, volume for extraction and time period.

Environmental (Water) Protection Policy 1997

The Environmental Protection (Water) Policy 1997 (EPP (Water)) governs the discharge of wastewater to land, surface waters and groundwater. It provides a framework for defining the environmental value of water and guidelines for water quality.

10.2.2 GROUNDWATER ASSESSMENT METHODOLOGY

The groundwater technical study for the MLA areas was undertaken during the period December 2007 to July 2008. It built upon the work done in the prefeasibility study undertaken (PB, 2007).

The groundwater technical study involved:

- literature and data search
- hydrocensus

- drilling and bore construction
- pumping test
- hydrogeological assessment, including hydrochemistry
- groundwater impact assessment.

Details of the groundwater study for the MLA areas, which includes some of the water pipeline are provided in Chapter 10, Section 10.2.1 in Volume 1 of the Environmental Impact Assessment (EIS).

The study area for the groundwater assessment included the south of the MLA area, therefore the hydrogeological information gathered for the original groundwater technical study is considered relevant for the proposed pipeline. Given the shallow depth of the proposed pipeline, a separate field study was not considered to be necessary for the proposed pipeline study area.

10.3 EXISTING ENVIRONMENT

10.3.1 GEOLOGY AND STRATIGRAPHY

The regional geology of the southern pipeline area is presented in Figure 10-1-V2.3. The geology and stratigraphy relevant to the study area are described in Chapter 9 (refer Section 9.3.2).

The proposed pipeline alignment is underlain by the rocks of the Great Artesian Basin (GAB). In the northern area these sediments comprise the Injune Creek Group, composed of the rocks of the Walloon Coal Measures, and sandstone formations. As the alignment moves to the south it is underlain by the GAB rocks of the Orallo Formation, the Gubberamunda Sandstone and the Kumbarilla Beds. Quaternary alluvial sediments and Cainozoic sands associated with the major stream lines of the Juandah and Dogwood Creeks, and their tributaries, unconformably overlie the GAB sedimentary rocks. These quaternary and Cainozoic sediments are likely to be relatively shallow.

10.3.2 HYDROGEOLOGY

Quaternary Alluvium and Cainozoic Sediments

The alluvium acts as an unconfined aquifer that is directly responsive to seasonal events such as rainfall and drought within the proposed southern water supply pipeline area. Water levels are found between 1 m and 8 m below ground level in the alluvium associated with the Frank, Mud and Woleebee Creeks. The alluvium associated with the Condamine River, Dogwood Creek and their tributaries is likely to have similar water levels. The groundwater within the alluvium is likely to be primarily dependent on streams for recharge. Discharge from the aquifer is likely to occur during dry periods and potentially supplies base-flow to the local stream systems and any dependent ecosystems. There is likely to be a strong groundwater/surface water connection between the groundwater in the shallow alluvium and the overlying surface water bodies.

Cainozoic sediments are likely to be shallow and are unlikely to contain any significant groundwater resources.

Great Artesian Basin Sedimentary Rocks

Kumbarilla Beds, Orallo Formation, Gubberamunda Sandstone

The Kumbarilla Beds, Orallo Formation and the Gubberamunda Sandstone are Jurassic to Cretaceous rocks of the GAB. They directly underlie the pipeline alignment from Miles north to approximately 4 km south of the mine lease application areas (Figure 9-2-V2.3). The exposed areas of these sandstone rocks are generally be considered to be intake beds for the greater GAB.

Injune Creek Group Rocks

The Injune Creek Group Rocks underlie the pipeline alignment in the area immediately to the south of the mine lease area. Groundwater occurs predominantly within fractures in the coal (primarily the cleats). Water strike in the Juandah Coal Measures is highly variable, varying from 27 to 120 m below ground, averaging around 95 m. The water bearing zones are up to 10 m thick. The inter-bedded sandstones, siltstones and shales act as semi-confining layers separating the water bearing zones within the coal seams. Regional groundwater flow is expected to be in a south-westerly direction (Habermehl and Lau, 1997).

The deeper water bearing zones are found in the Upper and Lower Macalister and Wambo coal seams. The Wambo is potentially the most transmissive seam, although transmissivities are still reasonably low. There is a reasonable horizontal hydraulic connection across the Project area in the deeper coal seams. The pumping test results however indicate that there is a low vertical hydraulic connection between the water bearing zones.

On a regional scale, units such as the Walloon Coal Measures, within the Injune Creek Rocks, occupies the sequence between the major aquifers and are usually fine-grained sediments and form confining layers so that aquifers are not considered hydraulically connected to the deeper underlying Great Artesian Basin aquifers (PPK Environmental and Infrastructure 2000, and Parsons Brinckerhoff and DNRM&E 2004).

Literature and data collection

The majority of previous studies have focused on the groundwater conditions of the deeper GAB, with little work available on the groundwater conditions of the Walloon Coal Measures around Wandoan or the alluvial sediments associated with the Condamine River and Dogwood Creek and their tributaries.

There is limited information available from the NRW registered bores on water levels, yields or water quality.

The Wandoan Joint Venture (WJV) exploration drill holes within the MLA areas are typically drilled to between 120 and 160 m total depth and target the Walloon (including Juandah) Coal Measures, although some holes extend up to 300 m in depth. Coal exploration drilling, particularly historic exploration, generally did not consider the groundwater conditions. However, recent bore logging has noted the presence of groundwater in drill holes and provided an estimate of flow.

Hydrocensus

The historic information on the bores within the southern pipeline route is limited to 4 NRW bores and 6 WJV monitoring bores. The bores identified in the proposed pipeline area are in the northern portion of the study area (refer Figure 10-2-V2.3).

Water level information and monitoring

The following information covers the northern end of the pipeline only. There is limited available groundwater data for the remainder of the pipeline. A previous groundwater monitoring drilling program (PB, 2008) included the installation of one production bore (R9095) and three monitoring bores (R9096, R9097, R9098). These have become additional bores in the monitoring network. The bores were drilled to target the coal seams of the Juandah Coal Measures, specifically the Kogan, Macalister and Wambo coal seams.

Historic water level and water quality monitoring at these sites has been intermittent. Monitoring data collected and archived for these monitoring bores is shown in Table 10-1.

For the majority of bores monitored, the water level response is reasonably stable over time with only minor water level changes observed in the newly constructed bores within the MLA area. These changes are likely due to the water levels stabilising following bore construction.

The bores located in the proposed pipeline area all had water levels between 40 and 120 m below ground, and are deeper than the water levels in the monitoring wells in the MLA area (refer Table 10-1). The table indicates that the shallowest top water strike is 27 m below ground, far below the expected depth of the pipeline, for areas underlain by the Injune Creek Group.

Table 10-1: Summary of bores close to proposed southern water supply pipeline area

Bore	Info source	Elevation (m)	Total depth (mbgl)	Top water strike (mbgl)	Bottom water strike (mbgl)	SWL (mbgl)
58910	NRW (not found)					
44000	NRW	350				
43772	NRW (verified, relocated)	300	61	57	61	
58910	NRW (not found)					
R6009	WJV	267.67	138	43	46	
R6011	WJV	277.37	120	102.75	105	
R6013	WJV	283.93	128.5	119.1	120	
R6281	WJV	285.79	126			
R6291	WJV	274.79	132			
C6390	WJV	282.77	120			
R9095	WJV	265.3	91	46	84	22.5
R9096	WJV	264.4	88	27	84	40
R9097	WJV	286.4	77	70	73	41.1
R9098	WJV	271.6	62	38	58	22.5

10.3.3 WATER QUALITY

Alluvium

There is no water quality data available for groundwater within the Quaternary Alluvium. It would be expected that water quality within these sediments would be similar to the overlying streams and is likely to be fresh. Further away from the stream lines, water quality would be influenced by the more saline groundwater of the Injune Creek rocks.

Injune Creek Group Rocks

Water quality in the bores located in the proposed southern water supply pipeline area was measured for field parameters (electrical conductivity (EC), pH and temperature) following bore construction. The data suggests that salinity is higher in the shallow coal seams of the Kogan (at EC values exceeding 20,000 µS/cm), with the deeper coal seams (Macalister and Wambo) showing slightly lower salinities (with EC values approximately 17,000 µS/cm). pH values suggest that Kogan coal seams are closer to neutral than the slightly alkaline deeper Macalister and Wambo coal seams (pH around 8).

10.4 DESCRIPTION OF PROPOSED DEVELOPMENT

The Project will include on-site coal handling and processing which will require a constant and reliable water supply. It is anticipated that operations raw water requirements will be up to 9,100 ML/a. A potential water resource to satisfy this demand has been identified at Berwyndale South CSM gas fields located south-east of the town of Condamine, approximately 93 km to the south of MLA 50230.

It is proposed to establish the proposed pipeline to beneficially re-use CSM gas waste water and secure a water supply for the Project. The proposed pipeline will transport water from a CSM water collection pond adjacent to the Condamine Power Station, approximately 93 km to the south-east of Wandoan to the raw water storage dam on the Wandoan Coal Project mine infrastructure area (MIA). Treatment of the CSM water to a standard suitable for use in coal handling and processing will be undertaken prior to the water leaving the Berwyndale South CSM gas field.

The pipeline will require a lift pump station in close proximity to the Condamine Power Station. Additionally, a header tank may be required (subject to detailed design) at a high point between the townships of Gurulmundi and Giligulgul in order to allow for gravity feed to the end point at the raw water dam at the mine infrastructure area. The pump will operate for 20 hours per day.

Pipe diameter size will be approximately 600 mm and will be located underground (approximately 1m deep), constructed using a section trench and backfill method.

There will be twenty nine stream crossings.

The pipeline is also proposed to intersect with and be located, in part, within the Leichhardt Highway reserve which is a state controlled road.

10.5 POTENTIAL IMPACTS

10.5.1 GROUNDWATER RESOURCES

The shallow depth of the pipeline means that impacts to the deeper aquifers during construction are unlikely. Potential impacts to shallow groundwater within alluvial sediments along the main stream lines may be encountered during the installation of the proposed southern water supply pipeline. However:

- the alluvium is not considered to be a significant groundwater resource and the potential for adverse impact is likely to be low
- the impacts are short term impacts to the alluvium during the pipeline installation
- water quality impacts will be very localised both horizontally and vertically.

10.5.2 ENVIRONMENT

Potential impacts to the environment as a consequence of the proposed pipeline are assessed as follows:

- no groundwater dependant ecosystems were identified and the impact, if any, would be short term
- base-flow to streams and changes to drainage lines in the medium to long term are unlikely to be affected
- there is potential for some localised groundwater contamination if a significant contamination incident occurs onsite, particularly if occurring in the alluvial sediments. The groundwater within the alluvial sediments and associated with the defined streams has the highest risk.

10.5.3 OPERATION OF PIPELINE

The potential impacts to groundwater if there is a leak in the pipe include:

- Pipeline water leaking into the alluvium, or the weathered rock sediments of the Injune Creek Group. The water salinity will be approximately 7,100 μS/cm (or around 4,000 mg/l). The water quality would then not likely impact the water quality of the more saline groundwater of the Injune Creek rocks, however some degradation would likely occur in alluvial systems.
- The exposed GAB rocks that overlie the Injune Creek Group are generally considered to be the intake beds for the GAB. Pipeline leakage into these rocks would have the potential to cause degradation of the water quality in the greater GAB. However, pipeline break and leakage detection systems would prevent or minimise the risk of occurrence of breaks or leaks.

10.6 MITIGATION MEASURES

10.6.1 GROUNDWATER

The temporary disturbance to alluvial groundwater systems is unlikely to require mitigation measures during construction of the pipeline. If possible, construction should be undertaken during the dry season and best practices should be employed to contain any spills.

10.6.2 ENVIRONMENT

The risk of contamination to groundwater from a spill or incident on site is highest at locations that directly overlie the alluvium. Machinery and potentially contaminating equipment will be stored and operated on adjacent weathered rocks rather than directly over the alluvium where possible. Chemical spill kits will be available on site in case of fuel spills and appropriate waste disposal protocols will be implemented.

10.6.3 OPERATION OF PIPELINE

A leakage detection system will be implemented to minimise the potential for leakage from the pipeline into adjacent agricultural land, alluvial sediments, or the GAB intake beds. Measures to account for water inputs or output (water balancing) would also be beneficial.

10.7 RESIDUAL IMPACTS

There is likely to be minimal groundwater encountered during the installation of the southern water supply pipeline. Short term impacts occurring during the pipe installation are likely to be minimal and further long term disturbance to the alluvium is unlikely. It is unlikely there will be any residual impacts to the pipeline area.

10.8 REFERENCES

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