Appendix 7

SURFACE WATER AND GROUNDWATER TRI-ANNUAL REVIEW

GeoTerra

TARRAWONGA COAL PTY LTD

SURFACE WATER AND GROUNDWATER 2006 / 2009 MONITORING TRI-ANNUAL REVIEW

Boggabri, NSW

TAR1-R1

27 NOVEMBER, 2009

GeoTerra Pty Ltd ABN 82 117 674 941

77 Abergeldie Street Dulwich Hill NSW 2203

Phone: 02 9560 6583 Fax: 02 9560 6584 Mobile 0417 003 502 Email: geoterra@iinet.net.au

TAR1-R1 (27 NOVEMBER, 2009)

GeoTerra

Tarrawonga Coal Pty Ltd
PO Box 600
GUNNEDAH NSW 2380

Attention: Danny Young

Danny,

RE: 2006/9 Surface Water and Groundwater Monitoring Tri-Annual Review

Please find enclosed a copy of the above mentioned report.

Yours faithfully

GeoTerra Pty Ltd

Andrew Dawkins (AuSIMM CP-Env)

Managing Geoscientist

Distribution:	Original	GeoTerra Pty Ltd
	1 electronic copy	Tarrawonga Coal Pty Ltd

GeoTerra Pty Ltd ABN 82 117 674 941

77 Abergeldie Street Dulwich Hill NSW 2203

Phone: 02 9560 6583 Fax: 02 9560 6584 Mobile 0417 003 502 Email: geoterra@iinet.net.au

TABLE OF CONTENTS

TABLES

FIGURES

PLANS

1. INTRODUCTION

The Tarrawonga Coal Mine lies within the catchment of the Namoi River and is located approximately 15km north east of Boggabri in the Gunnedah Coalfield.

This document provides a review of groundwater and surface water monitoring at the Tarrawonga Coal Mine within Mining Lease (ML1579) that has been conducted since the 2nd June 2006 at 6 private bores, as well as 8 piezometers installed by the mine (MW1-MW8). Additional monitoring of a further 11 private bores (Greentree A / B, Templemore A / B and BCS1-7) within 3km of the mine site was also undertaken on an intermittent basis to address concerns raised by those landholders.

Surface water monitoring is also conducted up and downstream of the mine site in Bollol Creek, in Nagero Creek and in off site water discharge dams.

The intial fieldwork was undertaken between October 2004 and February 2005 for the original environmental assessment studies. This report covers the initial assessment period as well as the three years of monitoring between June 2006 to the end of June 2009.

The approved Site Water Management Plan for the Tarrawonga Coal Mine (RW Corkery & Co Pty Ltd, 2007) and the Groundwater Contingency Plan for the Tarrawonga Coal Mine (RW Corkery & Co Pty Ltd, 2006) identify six private bores or wells and nineteen monitoring piezometers as shown in **Plan 1** and **Plan 2** that can be used to assess the groundwater level and water quality impacts (if any) on local groundwater aquifers as a consequence of mining and associated activities.

The monitoring is used to gain an understanding of natural variability and response times in the groundwater systems through assessing the groundwater chemistry and water level fluctuations.

This review is prepared in accordance with the project's development consent issued on the 9th November 2005 (DA 88-4-2005). The consent states the applicant should detail a Surface Water Monitoring Program, Groundwater Monitoring Program and a Groundwater Contingency Plan. All three documents were completed as shown in the Appendices section. In addition, Condition 32 of the consent indicated the applicant should also conduct an Independent Review of Monitoring;

"Within 3 years of commencing the development, and every 3 years thereafter, unless the Director General directs otherwise, the Applicant shall provide to the Department a review and report on surface and groundwater monitoring and observable trends. The report is to be completed by a suitably qualified and independent hydrogeologist, whose appointment has been approved by the Director-General."

1.1 Mining Progress

The Tarrawonga mine commenced operation in May 2006 and has been excavated to a maximum depth of approximately 60m below surface as of the end of June 2009.

The mine is being operated as an open cut progressing in an easterly and southerly direction, with development progressing as a single pit.

Rehabilitation is being conducted behind the advancing face of the pit.

The adjacent Boggabri mine is located approximately 0.5km to the north, within the Leard State Forest

1.2 Rainfall

Total daily rainfall for the mine site is shown in **Figure 1**.

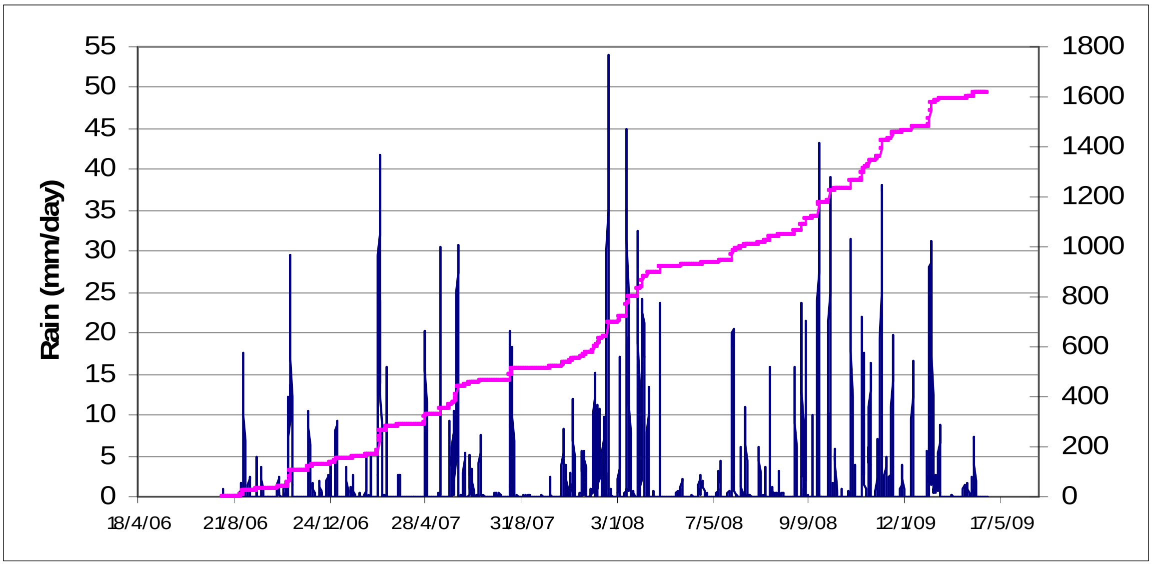

Figure 1 Daily Rainfall

2. GENERAL DESCRIPTION

2.1 Local Geology

The Tarrawonga Mine is located on the western side of the Maules Creek Sub-basin.

The Boggabri Volcanics outcrop in the westernmost part of ML1579, with coal seams and clastic rocks of the Maules Creek Formation subcropping in low hills in the northern part of the lease. In the central and southern parts, the Early Permian basement is obscured by extensive unconsolidated Quaternary alluvium that can be up to 50m thick.

The Maules Creek Formation onlaps the Boggabri Ridge in the west and thickens to over 400m deep along the eastern side of ML1579. A cumulative thickness of more than 20m of coal is developed in a group of eleven correlated major coal seams that subcrop across the ML. Eight of the seams are planned to be extracted, and these are the;

- Braymont
- Bollol Creek
- Jeralong
- Jeralong (lower)
- Merriown
- Merriown (Lower)
- Velyama, and
- Nagero Seams

2.2 Hydrogeology

The Tarrawonga Mine site has four aquifers, namely;

- elevated hydraulic conductivity alluvial sands and gravels which occur approximtely 1km to the east and south of the mine within and adjacent to Bollol Creek as well as to the north-west in Nagero Creek. The depth to water ranges from 5-10m, and flows to the south-west. Most of the wells/bores are only shallow with a limited saturated thickness.
- coal seams, with the groundwater being partially confined with low conductivity flow in fractures, joints, cleats and bedding. The hydraulic conductivity of the coal (5 x 10-6m/s) is generally an order of magnitude higher than the interburden strata.
- interburden, which acts as a semi-confining layer between the coal seams that provide vertical leakage to the coal through fractures and joints.
- the underlying Boggabri Volcanics. Groundwater flow in the basement volcanics occurs through low hydraulic conductivity fractures.

The average depth to groundwater in the mine area is approximately 38mbgl (RL270m), with standing water levels ranging from 10-96m below surface. The maximum pit depth is approximately 60m, which is below the regional water table.

Groundwater flows in a south west direction and is governed by the regional topography at a flow rate of about 0.5m to 1 m/year.

The coal seams and interburden aquifers (shale, sandstone, and conglomerate) have low yields (0.6-1.5L/sec), with the highest yields in the coal seams. The bores and wells are used for domestic and stock watering purposes, with only one bore (GW17148) used for irrigation.

The groundwater at Tarrawonga has the following chemical characteristics;

- pH from 6.9 to 8.1
- electrical conductivity from 680µS/cm to 3700µS/cm.
- cadmium, chromium, nickel and silver below detection limits.
- manganese from 0.05mg/L to 0.1mg/L
- lead ranging from 0.002mg/L in the volcanics to 0.09mg/L in the coal seams, which exceeds the current drinking water guidelines of 0.01 mg/L.
- copper to 0.03mg/L
- zinc to 0.13mg/L.

The groundwaters are generally sodium-bicarbonate/chloride dominated with slightly elevated TDS, copper, lead and zinc in the coal compared to the interburden.

3. GROUNDWATER MONITORING PLAN AND TRIGGER LEVELS

Monitored private bores and piezometers installed by the mine are listed in **Table 1**.

Table 1 Monitored Private Bores

Bore No. (GW)	Aquifer	Total Depth (m)	Standing Water Level (mbgl)	Saturated Thickness (m)	Yield (L/s)
2129	Coal	297.1	51.8	245.3	Not known
2501	Interburden	77.1	51.8	25.3	0.63
20432	Volcanics	48.8	21.1	27.7	Not known
31856	Bollol Ck Alluvium	50.3	15.76	34.54	Not known
44997	Bollol Ck Alluvium	45.7	4.6	41.1	Not known
52266	Bollol Ck Alluvium	91.4	9	82.4	Not known

Note: **-** The saturated thickness assumes the bore / well fully penetrates the aquifer, even though in some cases it does not, and therefore underestimates the actual saturated thickness of the formation.
- Bore GW507 is not included in the suite as it is damaged and can not be monitored

Table 2 indicates the details of the piezometers installed by Tarrawonga Coal on the mine site and in neighbouring private properties.

Monitoring from existing bores Greentree A & B, Templemore A & B and BCS1-7 was undertaken between July and September 2007 following landowner complaints that their groundwater levels were dropping.

Table 2 Monitored Piezometers

Piezometer	Aquifer	Screen Depth (m)	Initial Standing Water Level (mbgl)	Saturated Thickness (m)	Property
MW1	Coal	52.5-56	7.77*	48.23	Thuin
MW2	Bollol Ck alluvium	3.6-7.0	3.63*	3.37	Templemore
MW3	Volcanic	?-100	15.08*	84.92	Nagero
MW4	Bollol Ck Alluvium	18.1-20	8.80*	11.2	Tarrawonga
MW5	Bollol Ck Alluvium	3.3-8.3	2.78*	5.52	Templemore
MW6	Nagero Ck Alluvium	29-32	8.34*	23.66	Merriown
MW7	Permian	102-105	73.47*	31.53	Tarrawonga
MW8	Conglomerate	24-26	13.06*	12.94	Tarrawonga
Greentree A	Bollol Ck Alluvium	N.A	4.84^{+}	N.A	Greentree
Greentree B	Bollol Ck Alluvium	N.A	5.95^{+}	N.A	Greentree
Templemore A	Bollol Ck Alluvium	N.A	8.61^{+}	N.A	Templemore
Templemore B	Bollol Ck Alluvium	N.A	9.89^{+}	N.A	Templemore
BCS1	Bollol Ck Alluvium	N.A	8.39^{+}	N.A	Bollol Creek
BCS2	Bollol Ck Alluvium	N.A	7.01^{+}	N.A	Bollol Creek
BCS3	Bollol Ck Alluvium	N.A	4.69^{+}	N.A	Bollol Creek
BCS4	Bollol Ck Alluvium	N.A	5.97^{+}	N.A	Bollol Creek
BCS5	Bollol Ck Alluvium	N.A	4.79^{+}	N.A	Bollol Creek
BCS6	Bollol Ck Alluvium	N.A	5.52^{+}	N.A	Bollol Creek
BCS7	Bollol Ck Alluvium	N.A	9.67^{+}	N.A	Bollol Creek

NOTES: * June 2006 $^{+}$ July 2007 N.A. not available

The saturated thickness assumes the piezometer fully penetrates the aquifer, even though in some cases it does not, and therefore underestimates the actual saturated thickness of the formation.

Table 3 reproduces details on the "approved" monitoring frequency, parameters and sampling method for each bore, well or piezometer.

Table 3 Groundwater Monitoring Programme

Monitoring Bore	Parameter	Units	Method
Data Logger			
MW1, MW2	Standing Water Level	m AHD	In situ
Quarterly			
MW3, 4, 5, 6, 7, 8 GW2129, 2501, 20432, 31856, 44997, 52266	Standing Water Level	m AHD	In situ
Six Monthly			
MW1, 2, 3, 4, 5, 6, 7, 8 GW2129, 2501, 20432, 31856, 44997, 52266	Electrical Conductivity pH Lead	uS/cm n/a mg/L	Representative Sample Representative Sample Representative Sample
Yearly			
MW1, 2, 3, 4, 7, 8 GW2129, 2501	cations / anions / metals TPH / oil grease TN, NO_3-N, TP, TRP pH / EC	mg/L & uS/cm	Representative Sample

NOTE: Bore 507 not included in suite because it is damaged

3.1 Groundwater Level and Private Bore Yields

In addition to the manual private bore / well and Tarrawonga piezometer water level monitoring, pressure transducers were also installed in MW1 and MW2 in July 2006, which was discontinued in 2008.

No testing of private bore yields has been done by Tarrawonga Coal prior to mining, whilst post installation testing by the driller who installed the bore has only been conducted on GW2501.

No complaints of a bore or well's yield (as opposed to water levels) has been received to date for the local private bores and wells.

3.2 Predicted Private Bore Groundwater Drawdown

The predicted drawdown at the completion of mining in the private bores and wells is summarised in **Table 4**.

The drawdown was predicted to be less than 10% reduction in saturated thickness in all bores except GW002501.

Table 4 Predicted Drawdown for Monitored Private Bores

Bore (GW)	Property	Aquifer	Distance from Tarrawonga Pit (m)	Calculated Drawdown (m)	Saturated Thickness (m)	Saturated Thickness Decline %
526	Thuin	Volcanic	1200	2.7	70	3.8
2129	Merriown	Coal	200	10.2	245	4.2
2501	Nagero	Interburden	500	7.8	25.3	30.8
20432	Thuin	Volcanic	1600	2.0	25	8.0
44997	Templemore	Bollol Ck Alluvium	2000	0.45	41.1	1.1
52266	Tarrawonga	Bollol Ck Alluvium	2800	negligible	82.4	negligible

NOTE: Source RCA (2005)

The predicted cumulative effects from both the Tarrawonga and Boggabri mines, which started around the same time, indicate a potential for slightly greater drawdown in the alluvial aquifer along Bollol Creek compared to the effect of the Tarrawonga mine only (RCA, 2005).

The additional drawdown due to the Boggabri Mine was not considered to be significant as the Boggabri mine is further to the north of the alluvium than the Tarrawonga mine (RCA, 2005) as shown in **Table 5**.

Table 5 Cumulative Impact of Both Mines in Operation

Bore (GW)	Property	Aquifer	Distance from Tarrawonga Pit (m)	Cumulative Drawdown (both mines) (m)	% Decline in Saturated Thickness (Cumulative)
526	Thuin	Volcanic	1200	4.5	6.4
2129	Merriown	Coal	200	10.2	4.2
2501	Nagero	Interburden	500	7.8	30.8
20432	Thuin	Volcanic	1600	3.5	14.0
44997	Templemore	Bollol Ck Alluvium	2000	0.9	2.2
52266	Tarrawonga	Bollol Ck Alluvium	2800	negligible	negligible

3.3 Pit Groundwater Seepage

Water accumulating in the open cut is a combination of accumulated rainfall run-off from within the "open cut" catchment, dust suppression activities and groundwater seepage.

Water accumulating in mine void sumps is periodically pumped to surface storage or pumped direct to water carts for operational use. To record the volume of water pumped from these sumps, and therefore, to derive an estimate of groundwater accumulating in these areas, the following actions are undertaken:

- the pump is fitted with a water meter and the readings recorded monthly; or
- mine personnel record the approximate pumping rate and time period when water is pumped from the sumps.

Water meter records or individual pumping records are reconciled each year as part of the AEMR. It is acknowledged that this method of monitoring groundwater seepage volumes is not entirely accurate as rainfall and other water flows increase the recorded volume while evaporation decreases it. However, by recording the pumping details, an indication of the volume of groundwater seeping into the open cut can be obtained.

3.4 Predicted Pit Groundwater Inflow

The predicted groundwater inflow is shown in **Table 6**.

Table 6 Modelled Groundwater Seepage to the 0pen Cut

Year	Inflow (m^3/day)	Evaporation Rate (m^3/day)	Net Inflow (m^3/day)
2	650	1320 .	0
4	640	1150	0
6	700	1120	0
8	520	1050	0

NOTES: Source RCA (2005)

The predicted inflow rate is approximately half the evaporation rate, which indicates the pit should be generally dry, outside of accumulated influent rainfall runoff within the pit (RCA, 2005).

In addition, water pumped out of the pit is also monitored quarterly for its salinity to assess if it exceeds the ANZECC (2000) criteria for irrigation to moderately salt tolerant crops (4000µS/cm).

3.5 Groundwater Triggers

Table 7 presents groundwater level and chemistry trigger levels.

The trigger levels are assessed against a benchmark of the natural conditions which have been, or are in the process of being updated, through the on going monitoring program.

Table 7 Groundwater Trigger Levels and Benchmarks

Parameter	Measure	Benchmark	Trigger
Standing Water Level	Saturated Thickness	Baseline +/- natural fluctuation	15% reduction
Chemistry	EC	Baseline +/- natural fluctuation	15% increase
	pH	Baseline +/- natural fluctuation	15% increase / decrease
	Lead	0	0.01mg/L*

NOTE: * lead criteria based on ANZECC (2000) livestock watering criteria

In the event that monitoring indicates a trigger has been reached or is being approached, Tarrawonga Coal will commission a hydrogeologist to review the data.

The outcome of any review, including recommendations, are subject to discussion and agreement with the NSW Office of Water (NOW).

3.6 Groundwater Mitigation Measures

3.6.1 Groundwater Quantity

If the saturated thickness trigger level is achieved in any bore, Tarrawonga Coal will notify the affected landowner(s) and, if the mine's and NOW's hydrogeologists assess the reduction is a consequence of mining, mitigation measures will be initiated.

If monitoring identifies a reduction in a bore's saturated thickness exceeds a trigger level, and it is a consequence of mining, Tarrawonga Coal will enter into negotiations with the affected landowner/s to formulate an agreement which provides for one or a combination of:

- re-establishment of saturated thickness in the affected bore(s) through bore deepening;
- establishment of additional bores to provide a yield at least equivalent to the affected bore prior to mining;
- provision of access to alternative sources of water; and/or
- monetary compensation to reflect water extraction costs as a consequence of lowering pumps or installation of additional or alternative pumping equipment.

3.6.2 Groundwater Quality

Tarrawonga Coal recognises that a change in the beneficial use of the water should not occur as a consequence of its mining or mining-related activities. Groundwater is primarily used for irrigation and watering of livestock, and therefore the ANZECC 2000 irrigation and livestock guidelines are used as trigger levels. A trigger of pH or EC will initially lead to an increase in the analytes monitored and/or frequency of sampling to confirm the magnitude and extent of the change in water chemistry and to verify that the change is a consequence of mining.

An independent authority may also be used where a dispute arises as to the cause of the change, given that groundwater supply and quality can be affected by non-mining related factors such as bore siltation, aquifer depletion by large scale agricultural users, bacterial infection, fertilizer contamination etc.

4. GROUNDWATER MONITORING RESULTS

4.1 Bollol Creek Alluvium

Groundwater monitoring conducted to June 2009 in alluvium associated with Bollol Creek as shown in **Figures 2** to **4** indicates the following.

4.1.1 Groundwater Level

During the monitoring period, groundwater levels in MW2 and MW5 have remained essentially steady, whilst MW4 has fallen by approximately 1m and GW31856, 44997 and 52266 have fallen by approximately 2m compared to their initial levels.

The Templemore water levels are more erratic, with Templemore A varying by up to approximately 4m, although it is currently at a similar depth to its initial water level. Templemore B has an overall water level range of approximately 7m, and is currently slightly higher than its original depth of 10.0m. The decrease in Templemore B was associated with increased farming activity, rather than a mining induced effect (Tarrawonga Coal 2008).

Regular monitoring of Greentree A & B as well as BCS1-7 was mostly discontinued in April 2008 after it was established that the water levels were fluctuating according to windmill pumping rates and seasonal / rainfall conditions.

No sustained fall in groundwater levels of greater than 15% has occurred in the Bollol Creek alluvial aquifer, although MW4 (8.80-9.38mbgl = 5.2% of saturated thickness) and GW44997 (6.19-7.52mbgl = 3% of saturated thickness) show a downward trend over the 2006-09 monitoring period.

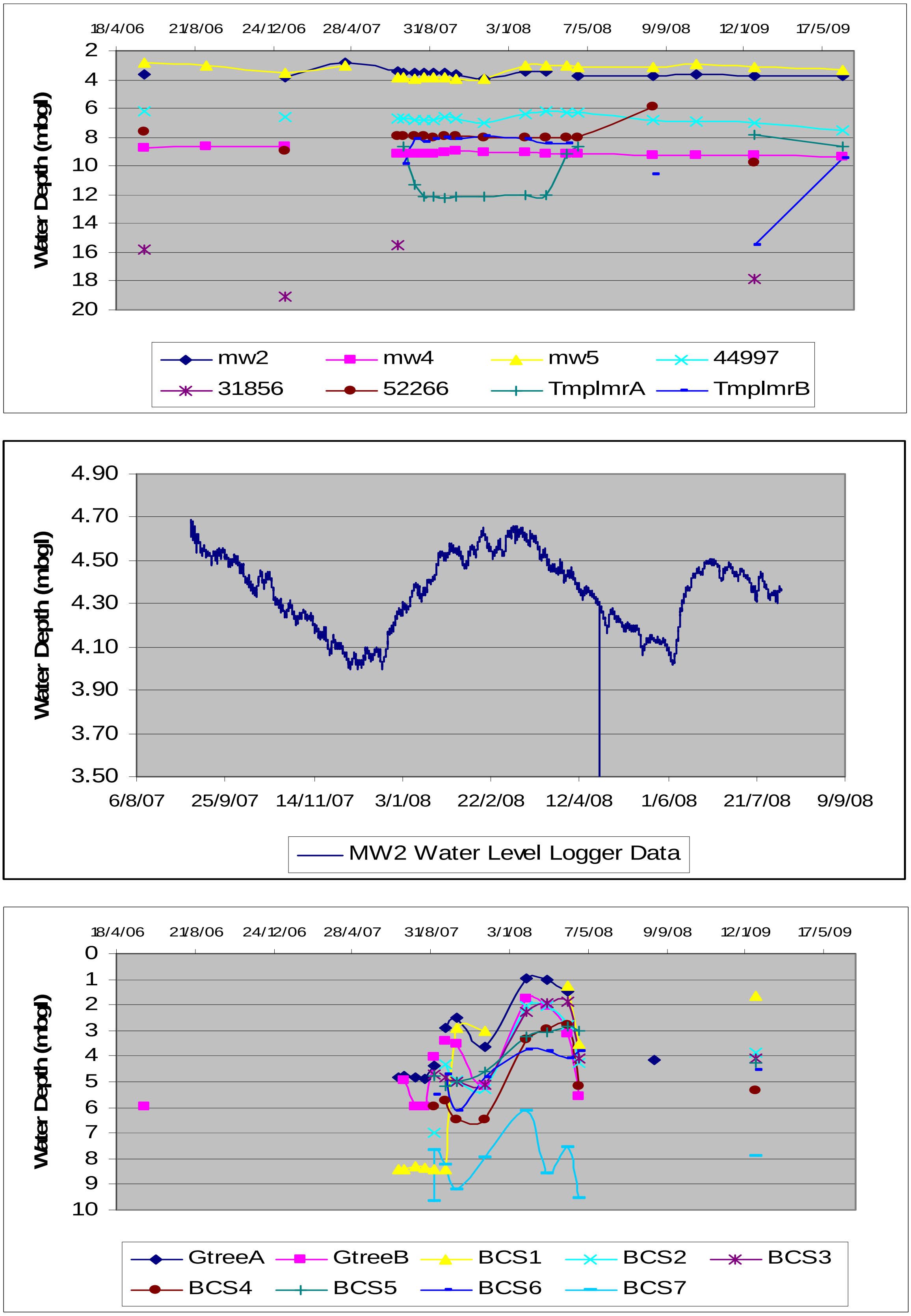

Figure 2 Bollol Creek Alluvium Standing Water Levels

4.1.2 Electrical Conductivity

The Bollol Creek alluvium has a salinity range between 400µS/cm and 5740µS/cm.

Over the monitoring period, salinity in all bores, piezometers and wells except MW5 and GW44997 have been essentially unchanged.

Piezometer MW5 has risen from an initial concentration of 1360µS/cm in July 2007 to the last reading of 2390µS/cm in June 2009, whilst GW44997 has risen from 785µS/cm to 3580µS/cm within the three year monitoring period. There are insufficient monitoring points to derive a clear long term trend, however, if the initial MW5 and GW44997 readings are discounted, as the piezometer and bore may have been inadequately purged in the first readings, MW5 is trending to being less saline, whilst GW44997 is essentially static.

All samples are within the ANZECC (Agriculture Irrigation and Livestock) criteria except for MW4, which has both baseline and long term salinities in excess of the 4000µS/cm criteria.

A rise of greater than 15% change in salinity was monitored in MW5 and GW44997, however ongoing monitoring will be used to assess the longer term trend at these locations

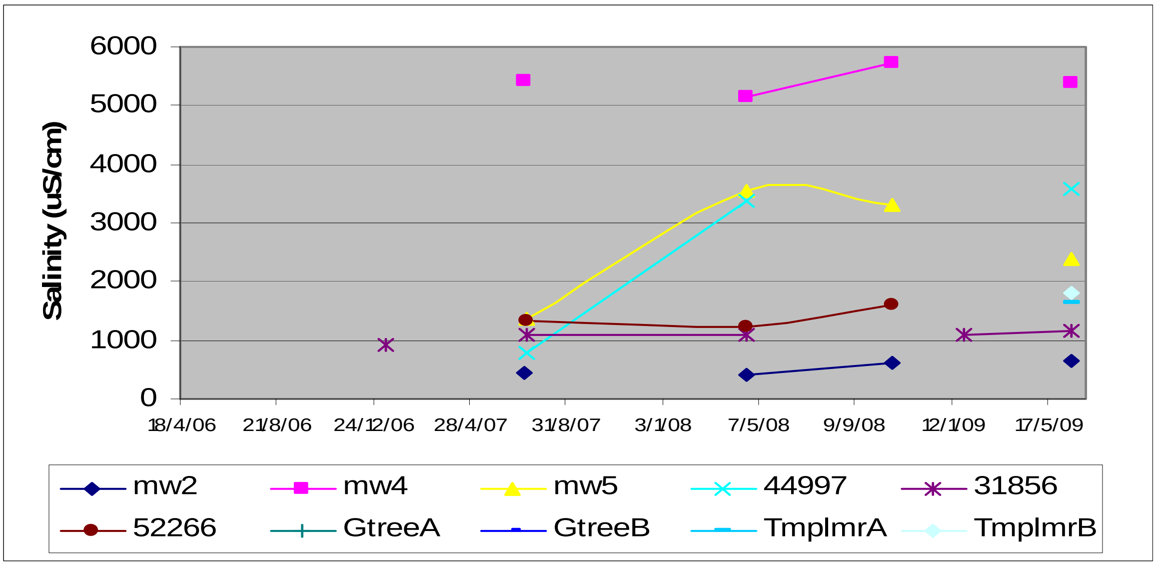

Figure 3 Bollol Creek Alluvium Electrical Conductivity

4.1.3 pH

Groundwater in the Bollol Creek alluvium over the monitoring period was essentially unchanged and generally lies within the 6.82 to 8.01 range, however GW52266 has had one outlier above pH 8.5 in October 2008, with a pH of 8.7.

It should be noted that pH is measured in a logarithmic scale, and that adherence to the ANZECC 2000 criteria range is a more appropriate criteria than comparing a numerical change of more / less than 15%.

All samples except one reading in October 2008 at GW52266 were within the ANZECC criteria of 6.5 to 8.5.

No sustained rise or fall in pH was monitored during the 2006-09 monitoring period

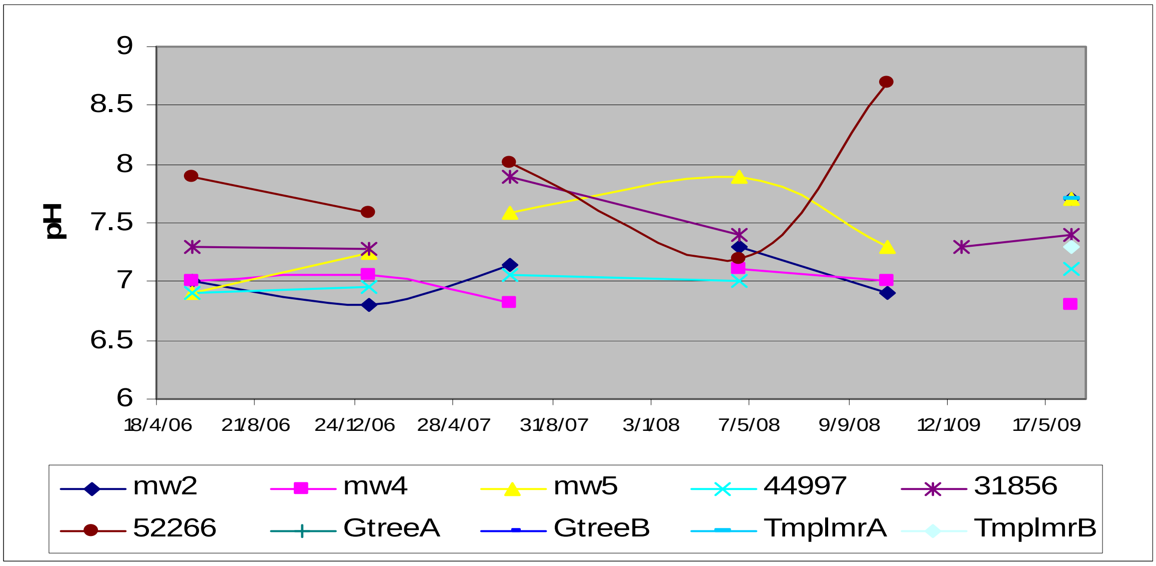

Figure 4 Bollol Creek Alluvium pH

4.1.4 Laboratory Analyses

Groundwater in the Bollol Creek aquifer has been within the ANZECC 2000 (Agricultural Irrigation or Livestock) criteria and no triggers have been exceeded over the 2006-09 monitoring period.

4.1.5 Summary

No Bollol Creek alluvial aquifer groundwater level, groundwater quality or saturated thickness triggers (as outlined in the Groundwater Contingency Plan for the Tarrawonga Coal Mine) have been exceeded in the 2006 / 2009 monitoring period that require a hydrogeologist to be commissioned to review the data.

4.2 Nagero Creek Alluvium

Groundwater monitoring conducted between June 2006 and July 2009 in alluvium associated with Nagero Creek as shown in **Figures 2** to **4** indicates the following.

4.2.1 Groundwater Level

The MW6 groundwater level has fallen by approximately 1.05m and then recovered to its initial level over the 2006-09 monitoring period in response to drought and subsequent higher rainfall periods.

Groundwater levels in MW8 over the 2006-09 monitoring period have steadily fallen by 0.96m.

No sustained fall in groundwater levels of greater than 15% have occurred in the Nagero Creek alluvial aquifer in the 2006-09 monitoring period, however a steady decline of 0.96m has occurred in MW8 (which is 7.4% of its saturated thickness).

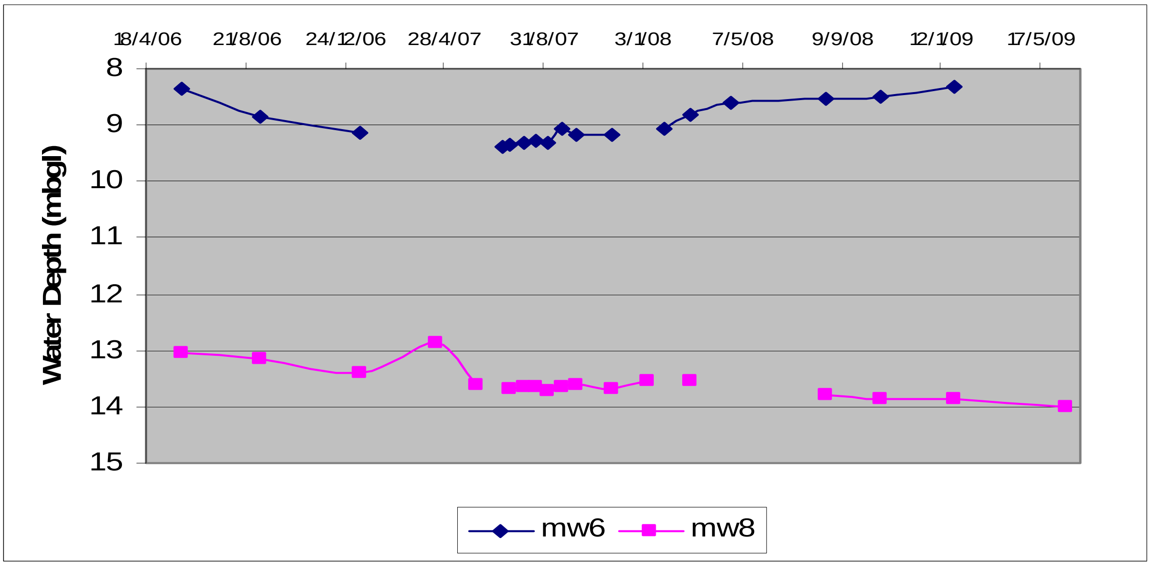

Figure 5 **Nagero Creek Alluvium Standing Water Levels**

4.2.2 Electrical Conductivity

The Nagero Creek alluvium has a salinity range between 2000µS/cm and 2030µS/cm.

Over the monitoring period, salinity in MW6 has remained essentially unchanged, whilst insufficient data is available for MW8 to identify a trend. Sampling was restricted at MW8 due to a blockage in the piezometer which is expected to be rectified during the next monitoring period scheduled for December 2009.

All samples are within the ANZECC (Agriculture Irrigation and Livestock) criteria.

No sustained rise of greater than 15% change in salinity was monitored in 2006-09

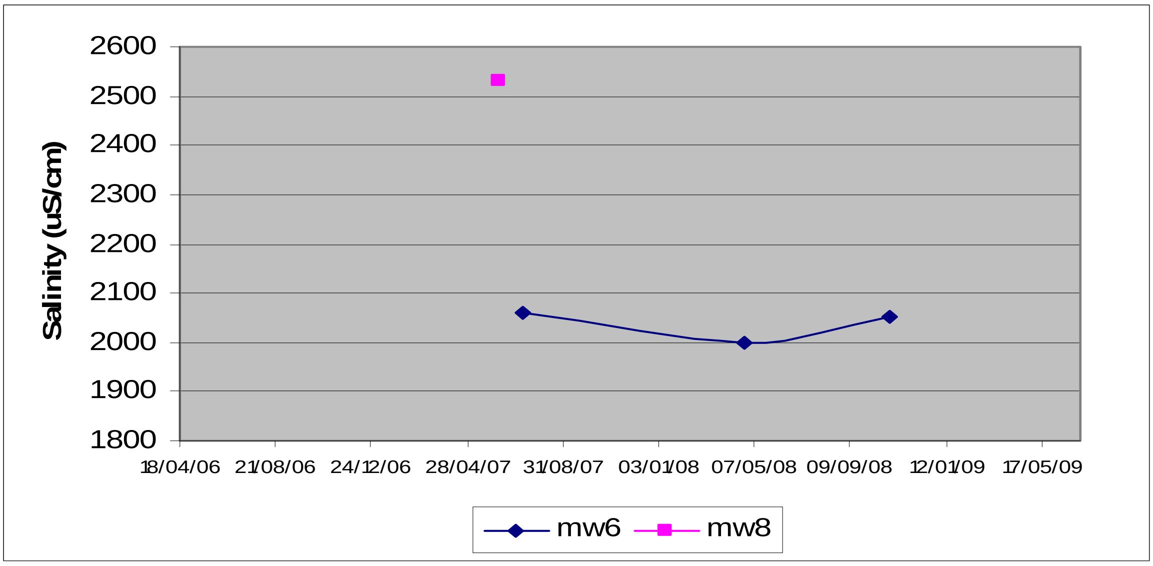

Figure 6 Nagero Creek Alluvium Electrical Conductivity

4.2.3 pH

Groundwater pH in the Nagero Creek alluvium within MW6 and MW8 over the last three years was essentially unchanged and lies within the 6.7 to 7.5 range.

It should be noted that pH is measured in a logarithmic scale, and that adherence to the ANZECC 2000 criteria range is a more appropriate criteria than comparing a numerical change of more / less than 15%.

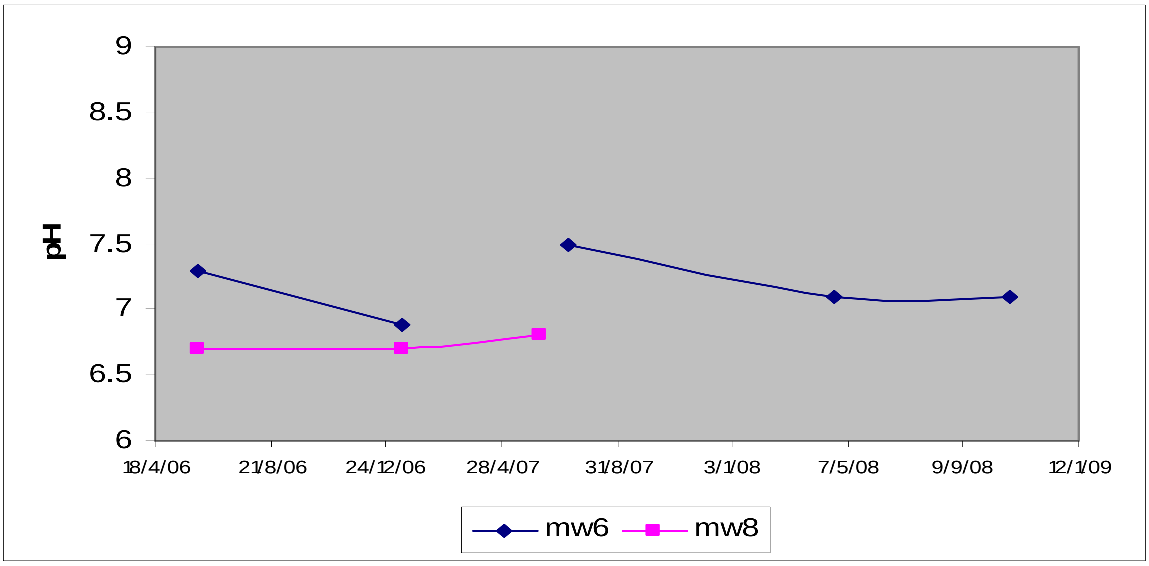

Figure 7 Nagero Creek Alluvium pH

All samples are within the ANZECC criteria of 6.5 to 8.5.

No sustained rise or fall in pH was monitored during the 2006-09 monitoring period

4.2.4 Laboratory Analyses

No ANZECC 2000 (Agricultural Irrigation or Livestock) criteria or trigger values have been exceeded in the 2006-09 monitoring period.

4.2.5 Summary

No Nagero Creek alluvial aquifer groundwater level, groundwater quality or saturated thickness triggers (as outlined in the Groundwater Contingency Plan for the Tarrawonga Coal Mine) have been exceeded in the 2006 / 2009 monitoring period that require a hydrogeologist to be commissioned to review the data.

4.3 Permian Coal Measures

The results of groundwater monitoring in the Permian Coal Measures are presented in the following sections, and refer to plots of the data shown in **Figures 8** to **10**.

4.3.1 Groundwater Level

The groundwater level in bores MW1 and GW2501 have been essentially static over the last three years of monitoring.

The groundwater level in GW2129 has fallen from the initial 23.06mbgl to 26.2mbgl over the last 3 years, which is 13.6% of its standing water level or 1.3% of its saturated thickness. It should be noted, however, that the bore was drilled to 297m deep with an indicated inflow from coal between 56.4m to 57m below surface. The reduction in water level in GW2129 is potentially not due to pit dewatering, as GW2501, which is closer to the pit, does not show the same depressurisation trend. There has been no pumping from the Production Bore GW968397 since 2007 as the initial production bore was mined through as it was within the footprint of the mine, so wouldn't be affecting the water levels in GW2129.

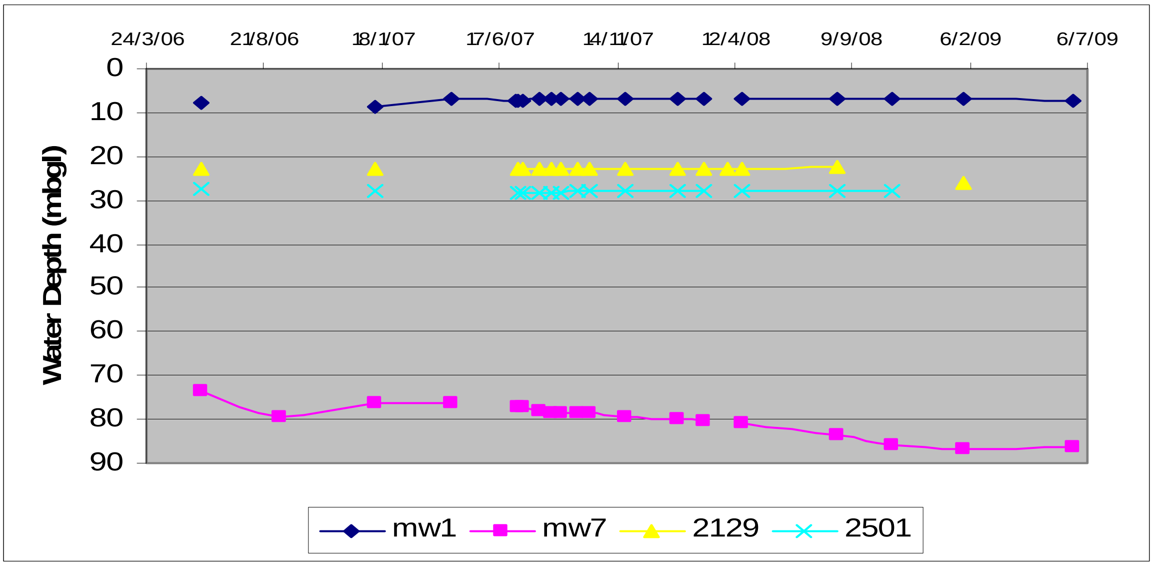

Figure 8 **Permian Coal Measures Standing Water Level**

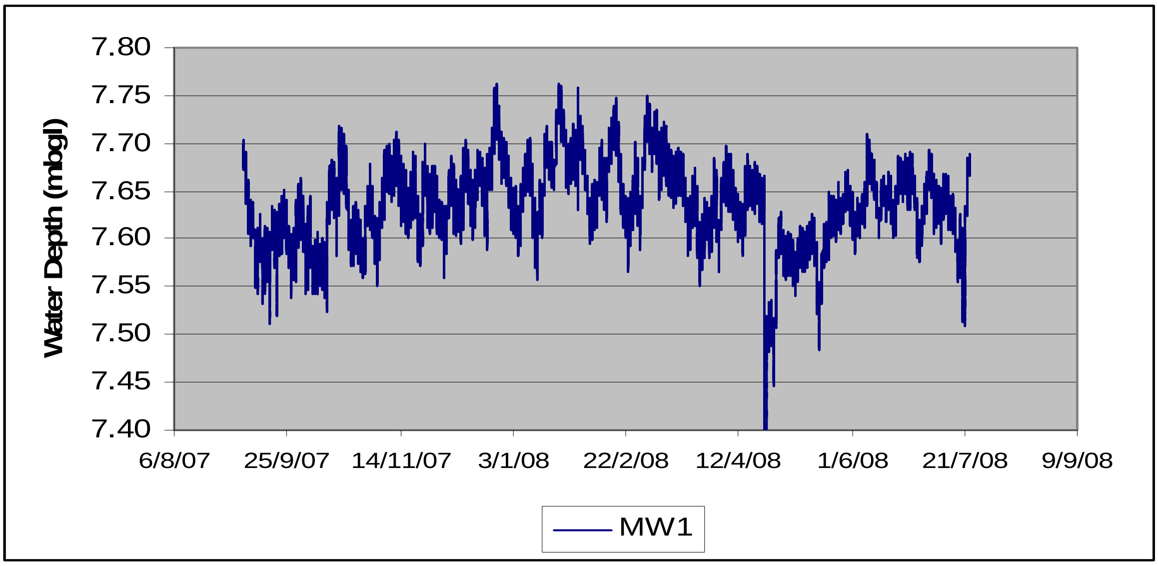

Figure 9 MW1 Water Level Logger Data

The groundwater level in MW7 has fallen by 12.98m from its initial 73.47mbgl to 86.45mbgl over the last 3 years, which is 17.6% of its standing water level or 41% of its saturated thickness. It should be noted, however, that the concept of saturated thickness in a confined coal seam aquifer at 102-105m below surface where the standing water level is due to lithostatic and hydrostatic confining pressures does not strictly apply, and it is more relevant to unsaturated alluvial aquifers. Never the less, it is apparent that MW7 is being depressurised by a transmitted reduction in groundwater pressures due to excavation of both the Tarrawonga and Boggabri pits.

A sustained fall in groundwater level of greater than 15% of the standing water level and saturated thickness has occurred in MW7, whilst the potential start of a groundwater decline, which hasn't yet exceeded its triggers, may be occurring in GW2129 over the 2006-09 monitoring period.

4.3.2 Electrical Conductivity

The Permian bores and piezometers have a salinity range of 990µS/cm to 6080µS/cm.

Over the monitoring period, salinity has remained essentially static in MW7 and GW2129, has risen by 124% from 2440 – 5470µS/cm in MW1 and has fallen from 6080-4500µS/cm in GW2501.

MW7 and GW2129 are within the ANZECC (Agriculture Irrigation and Livestock) criteria, whilst MW1 and GW2501 exceed the criteria.

A sustained rise of greater than 15% in salinity occurred in MW1 during the 2006-09 monitoring period.

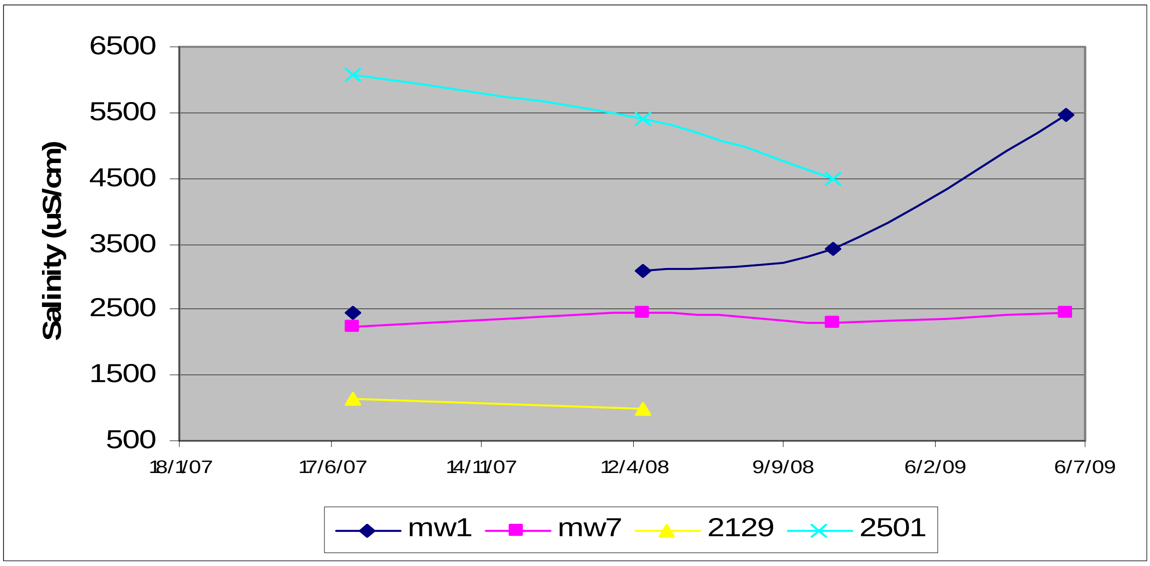

Figure 10 Permian Coal Measures Electrical Conductivity

4.3.3 pH

Groundwater pH in the Permian basement in the last three years has ranged from pH 6.15 to 9.1 and, as a group, show no distinctive trends over the monitoring period.

GW2501 is marginally below the lower range, whilst baseline and long term monitoring indicates GW2129 exceeds the upper range of the pH 6.5 to 8.5 criteria.

No sustained rise or fall of greater than 15% change in pH was monitored during the 2008/2009 monitoring period

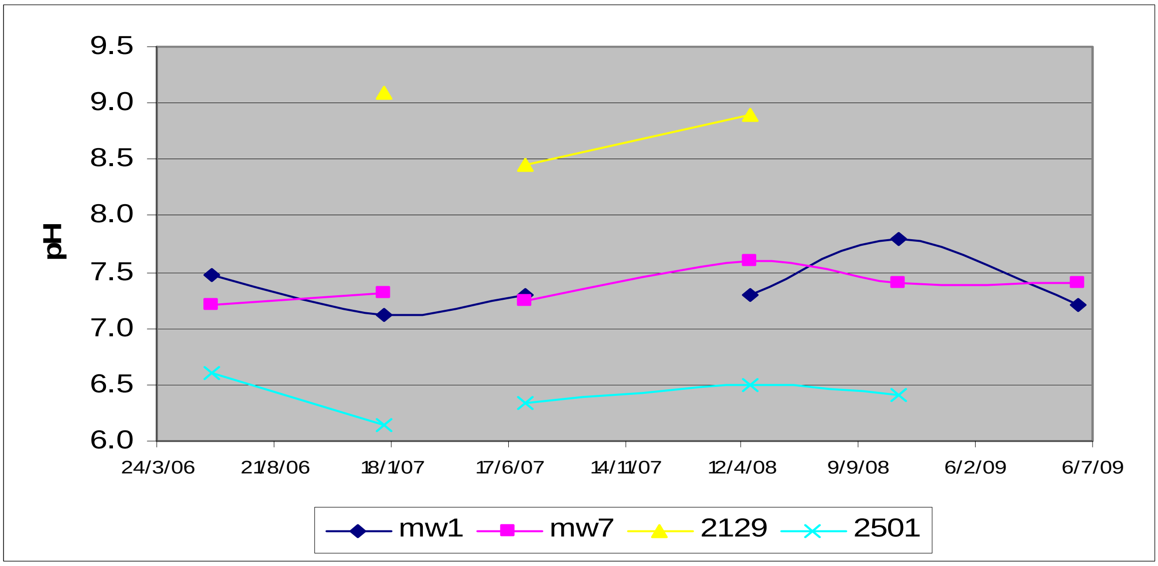

Figure 11 Permian Coal Measures pH

4.3.4 Laboratory Analyses

Bore water has remained relatively consistent and within guidelines for all bores except MW1, which has exhibited increases in zinc, copper and nickel, whilst exceeding the livestock drinking water trigger level of 0.01mg/L for lead, with 0.37mg/L.

MW1 exceeded the 0.01mg/L trigger level (with 0.37mg/L) during the 2006-09 monitoring period.

4.3.5 Summary

The reduction in groundwater levels in MW7 from 73.47 – 86.45 mbgl would be due to transmitted depressurisation from excavation of the Tarrawonga and adjoining Boggabri open cut coal mines. The depressurisation has not, however, adversely affected any private bores during the 2006-09 monitoring period.

The explanation for the rise from 2440 – 5470µS/cm along with increases in zinc, copper and nickel, along with the trigger exceedance for lead with 0.37mg/L in MW1 is not yet known, and further monitoring will be used to assess if the trend continues.

Groundwater in GW2129 and GW25021 was outside the pH trigger criteria between 2006 and 2009, however the pH of both bores has been predominantly outside the criteria since monitoring began, and is not considered to be mining induced.

4.4 Boggabri Volcanics

Groundwater monitoring in the Boggabri Volcanics as shown in **Figures 11** to **13** and discussed in the following sections indicates the following results and trends.

4.4.1 Groundwater Level

The groundwater level during the last three years in MW3 was relatively static, although overall it has risen from 15.01m to 13.78mbgl. Insufficient data is available to indicate any trend in GW20432.

No sustained fall in groundwater levels of greater than 15% have occurred in the Tarrawonga bores and piezometers during the 2006-09 monitoring period.

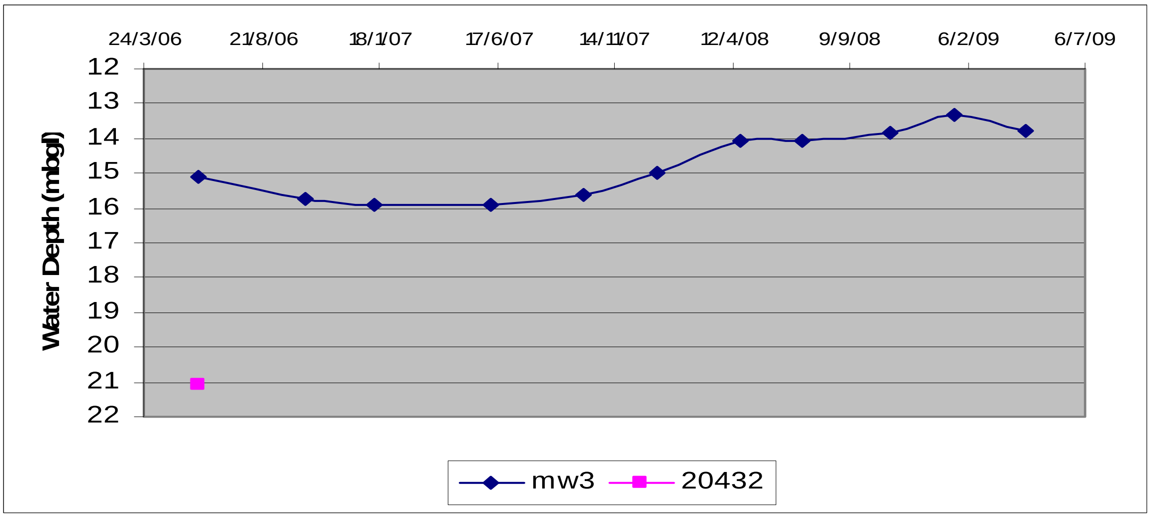

Figure 12 Boggabri Volcanics Standing Water Level

4.4.2 Electrical Conductivity

The Boggabri Volcanics piezometer MW3 has a salinity range of 1,540µS/cm to 1780µS/cm, and over the monitoring period, its salinity has risen by 16%.

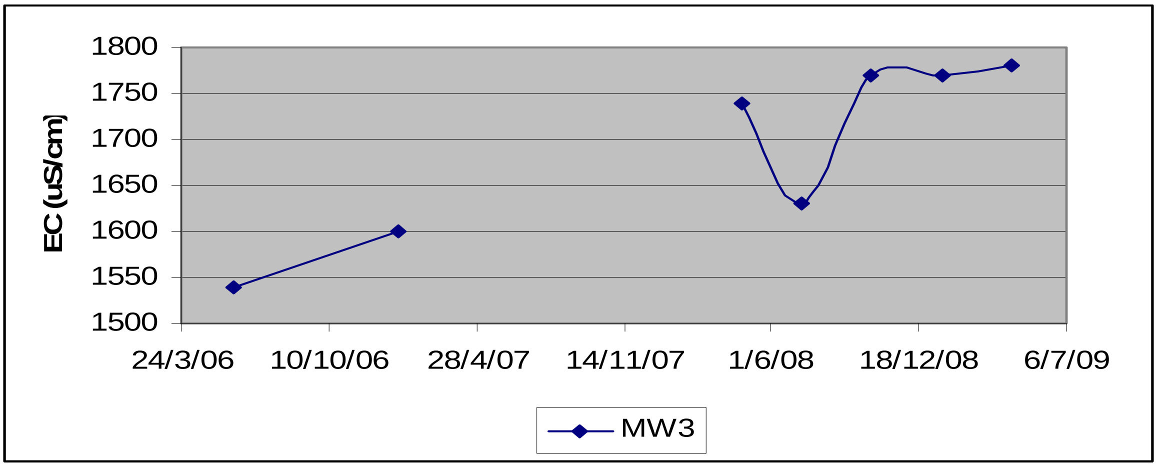

Figure 13 Boggabri Volcanics Electrical Conductivity

MW3 salinity is gradually rising, whilst no sampling data is available for GW20432.

4.4.3 pH

Groundwater pH in the Boggabri Volcanics ranges from approximately 6.8 to 7.9 and has shown no distinctive changes in the monitoring period, apart from one outlier of pH 6.8 in MW3 during October 2007.

All samples are within the ANZECC criteria of 6.5 to 8.5.

No sustained rise or fall of greater than 15% change in pH has been monitored in the 2006-09 monitoring period.

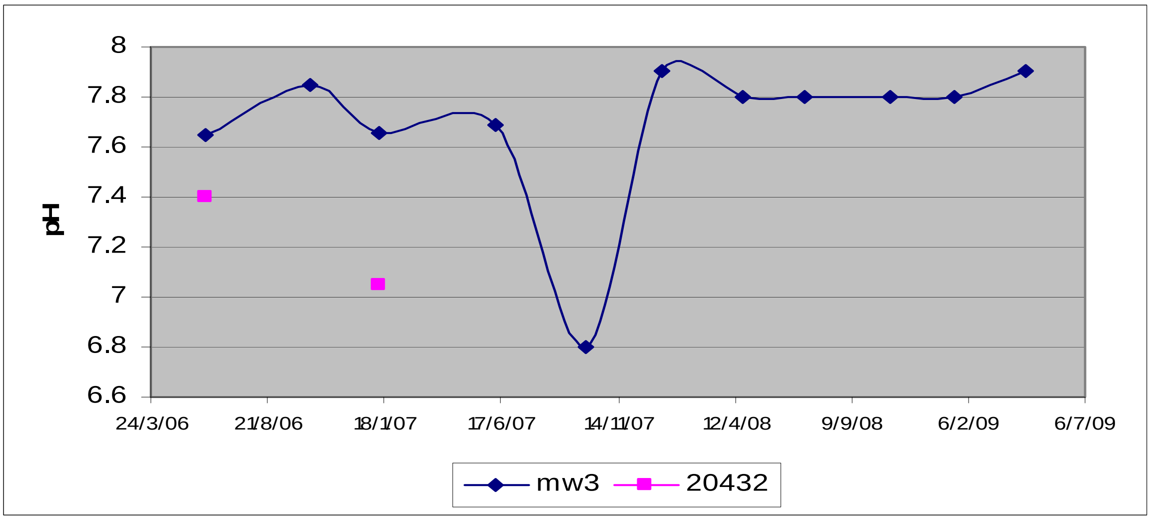

Figure 14 Boggabri Volcanics pH

4.5 Laboratory Analyses

No ANZECC 2000 Agricultural criteria or triggers have been exceeded in the 2006-09 monitoring period within the Boggabri Volcanics.

4.5.1 Summary

No groundwater level, saturated thickness or water quality triggers have been attained or exceeded in the 2006-09 monitoring period.

4.6 Groundwater Extraction from Productions Bores

The groundwater extracted from licensed bores on the site are shown in **Table 8**.

Table 8 Annual Groundwater Bore Use

Year	Pumping Volume (ML)
2006/7	17
2007/8	8
2008/9	0

4.7 Tarrawonga Pit Groundwater Seepage

The monitored annual groundwater seepage into the Tarrawonga Pit is well below the predicted inflows due to the high annual evaporation rate. The water pumped out of the pit shown in **Table 9** includes all combined rainwater, dust suppression and groundwater seepage pumped from the pit.

Table 9 Annual Pit Water Pumping

Year	Pumping Volume (ML/yr)	Predicted Groundwater Inflow (ML/yr)
1 (2006/7)	28	< 237.25
2 (2007/8)	32	237.25
3 (2008/9)	45	233.6 – 237.25

5. SURFACE WATER MONITORING PLAN AND TRIGGER LEVELS

The location of all surface water monitoring in Bollol Creek and Nagero Creek as well as mine discharge locations is shown in **Plan 1**, whilst **Table 10** identifies the monitoring point locations, type of monitoring point along with a brief description (where relevant) of the location.

Table 10 Surface Water Monitoring Locations

EPA Identification No.		Type of Monitoring Point	Description of Location
Year 1	SD9, 17	Wet Weather Discharge	All storage dams overflow points where the overflow exits the mine site
Year 2	SD9, 17, 20		
Year 4	SD9, 16, 17, 20		
Year 6>	SD9, 16, 17, 20		
BCU, BCD, NCU, NCD		Water Quality	Upstream and downstream of the confluence of Bollol and Nagero Creeks
SD1-10, MV1		Water Quality	All storage dams and the mining void on the mine site
All DBs, CBs, SDs, WW1 and identified areas of erosion or sedimentation		Erosion and Sediment Control	All noted surface water management structures and areas of previously identified erosion or sedimentation

NOTE: SD = storage dam SB = sediment basin MV = mine void WW = waterway DB = diversion bank CB = catch bank

Table 11 presents the parameters to be monitored, frequency of monitoring and sampling methods in Bollol Creek and Nagero Creek.

Table 11 Wet Weather Discharge Points, Bollol Creek and Nagero Creek

Parameter	Unit of measure	Frequency	Sampling Method
Total Suspended Solids	mg/L	Within 12 hours after overflow commences	Representative sample
Grease & Oil	mg/L		Representative sample
pH			Representative sample
Conductivity	µS/cm		Representative sample

Table 12 presents the parameters to be monitored, frequency of monitoring and sampling methods in the storage dams and pit void.

Table 12 Storage Dams and Mining Void

Parameter	Unit of measure	Frequency	Sampling Method
Total Suspended Solids	mg/L	Quarterly	Representative sample
Grease & Oil	mg/L		Representative sample
pH			Representative sample
Conductivity	µS/cm		Representative sample
Representative metals	mg/L	Annual	Representative sample
Representative ions	mg/L		Representative sample
Erosion	-	Quarterly or following Rainfall of >25mm/24hr	Representative sample
Sedimentation	-		Representative sample

5.1 Surface Water Assessment Criteria

The surface water assessment criteria only applies to water that discharges from the mine site as shown in **Table 13**.

The monitored values for all other parameters are tabulated and plotted, where appropriate, to identify any trends over time.

Table 13 Surface Water Assessment Criteria

Pollutant	Unit of measure	50% concentration limit	90% concentration limit	3DGM concentration limit	100% concentration limit
Total Suspended Solids	mg/L	20	35	-	50
Salinity	µS/cm	-	-	-	4000
Grease & Oil	mg/L	-	-	-	10
pH	-	-	-	-	6.5 – 8.5

DECCW will be notified in the event of increasing levels of any parameter or exceedances of ANZECC guideline levels for agricultural use (NEPM, 1999).

6. STREAM MONITORING AND OFF SITE DISCHARGE MONITORING

Within the vicinity of the Tarrawonga mine, surface water resources are limited to a number of ephemeral drainage lines which flow for short periods after substantial rainfall, farm dams, and water storage dams and a series of interlinked sediment basins as shown on **Plan 1**.

Where practicable, water collected on-site is retained or reused, with water for dust suppression sourced from a combination of on-site water harvesting, inflows from the exposed coal seam, overburden and interburden and groundwater extraction.

Five monitored surface water discharges occurred in the 2006 - 09 monitoring period into either Bollol Creek and/or Nagero Creek as shown in **Tables 14** and **15**, however no criteria were outside of, or exceeded the limits specified under EPL 12365 for parameters between the upstream and downstream monitoring locations except for;

- pH in Bollol Creek and total suspended solids in Nagero Creek on 1 March 2007, and
- pH in Bollol Creek on 23 August 2007.

Given the surrounding land use in the general locality of agriculture and cultivation, it is generally difficult to achieve the specified total suspended solids (TSS) criteria of 50 mg/L, particularly if the TSS upstream of the mine levels exceeds the criteria.

Table 14 Discharge Events

Date	Source	Discharge Volume	Rain	Streams Flowing During Discharge
1/03/07	SD1	Low	83.2mm in Feb and 23mm on 1st Mar 07	Bollol / Nagero Cks
23/08/07	SD8	N.A.	48.2mm in previous 7 days	Bollol Creek
17/01/08	SD17	Minor	55.8mm in previous 2 days	Bollol Creek
6/02/2008	SD8 SD9 SD17	N.A.	133.8mm in Jan08 + 33.2mm 1-6 Feb	Bollol Creek
17/02/2009	SD9	N.A.	100mm in preceding 7 days	Bollol Creek

Table 15 Surface Water Quality in Local Creeks After Discharge Events

Discharge	EPL Site No.	pH	Electrical Conductivity (uS/cm)	TSS mg/L	Oil and Grease mg/L
CRITERIA		**6.5 - 8.5**	**4000**	**50**	**10**
1 March 07					
SD1	WW1	7.5	540	***524***	3
BCU	WW5	6.8	165	***193***	<2
BCD	WW6	***6.4***	105	***45***	4
NCU	WW7	7.0	105	***78***	4
NCD	WW8	6.5	65	***304***	<2
23 Aug 07					
SD9		6.8	475	5	2
BCU	WW5	6.8	180	46	2
BCD	WW6	***6.2***	110	23	<2
17 Jan 08					
SD9		7.4	725	***173***	<2
SD16	WW3	7.3	570	***100***	<2
SD17	WW1	7.6	425	***837***	<2
6 Feb 08					
SD9	WW2	7.4	220	42	<2
SD17	WW1	7.9	420	***476***	<2
BCU	WW5	7.1	120	20	<2
BCD	WW6	7.3	135	9	<2
19 Feb 09					
SD9		7.1	90	22	<2
BCU	WW5	6.8	275	35	2
BCD	WW6	6.5	130	32	<2

pH in Bollol Creek and total suspended solids in Nagero Creek on 1 March 2007, as well as pH in Bollol Creek on 23 August 2007 exceeded the Surface Water Assessment Criteria compared to the upstream value.

7. SEDIMENT CONTROL STRUCTURES

7.1.1 2006 / 07

The sediment control structures in 2006/07 maintained their structural integrity with some minor scouring due to the prolonged drought which limited groundcover establishment.

The TSS at the Bollol Creek downstream sampling point during the year was significantly reduced, indicating the sediment filters within the Tarrawonga system were working appropriately. The TSS in Nagero Creek were elevated, however, the sediment attributable to the Tarrawonga operation is difficult to ascertain given the low level of discharge and the existence of the Idemitsu Boggabri operation which is closer to Nagero Creek.

Throughout the year, water levels in the storage dams were low due to limited inflows.

7.1.2 2007 / 08

The elevated TSS of 476 - 837mg/L from SD17 was related to a severely eroded waterway which could not be repaired initially due to the wet, boggy ground conditions. The waterway was subsequently reconstructed, rock lined and revegetated between February and April 2008.

7.1.3 2008 / 09

The sediment control structures maintained their structural integrity and worked appropriately during the monitoring year.

8. CONCLUSIONS

Surface water and groundwater monitoring up to June 2009 has identified the following trigger exceedances;

- >15% long term decline in standing water level and saturated thickness in MW7
- >15% long term rise in salinity as well as exceedance of 0.01mg/L lead trigger in MW1
- > 15% rise in salinity occurred in MW5 and GW44997, however ongoing monitoring will be used to assess the longer term trend at these locations
- one reading in October 2008 at GW52266 exceeded the pH trigger of 8.5

In general, groundwater levels have generally risen since the end of the long term drought around mid to late 2007, however a trend of localised groundwater depressurisation has been observed in MW7 in the Permian basement adjacent to the Tarrawonga mine as well as in the Bollol Creek alluvium in MW4 and GW44997 and at MW8 in the Nagero Creek alluvium. To date, only the MW7 decline has exceeded the relevant groundwater level and saturated thickness trigger.

The regional groundwater level drawdowns in private bores and pit dewatering are within the range predicted in the EIS (RCA, 2005) and do not require any additional investigations.

The total suspended solids levels downstream of the Tarrawonga Mine exceeded the upstream levels in Nagero Creek in March 2007, whilst the downstream pH was below the lower trigger of 6.5, and less than the upstream pH in Bollol Creek in March 2007 and August 2007.

A severely eroded waterway which discharged into SD17 developed on site in the 2007/08 period which necessitated reconstruction and revegetation of the waterway. Since it was reconstructed, the waterway is performing according to criteria.

No further investigation of the cause of groundwater level reduction or groundwater / surface water quantity or quality exceedances is required at this stage.

9. RECOMMENDATIONS

In accordance with the Site Water Management Plan, the following monitoring actions should be conducted;

- annual analysis of total nitrogen, nitrate nitrogen, total phosphorous and total reactive phosphorous in MW1, 2, 3, 4, 7, 8 as well as GW2129, 2501
- re-installation of water level transducers / loggers in MW1 and MW2
- electrical conductivity should be monitored in MW3 and GW20432

10. REFERENCES

ANZECC, 2000	An Introduction to the Australian and New Zealand Guidelines For Fresh and Marine Water Quality
RW Corkery & Co, 2006	Groundwater Contingency Plan for the Tarrawonga Coal Mine
RW Corkery & Co, 2007	Site Water Management Plan for the Tarrawonga Coal Mine
RCA Australia, 2005	Groundwater Assessment of the Proposed East Boggabri Coal Mine
RCA Australia, 2007	Groundwater Monitoring Report, Tarrawonga Coal Mine
Tarrawonga Coal, 2007	Annual Environmental Monitoring Report for the Tarrawonga Coal Mine
Tarrawonga Coal, 2008A	Annual Environmental Monitoring Report for the Tarrawonga Coal Mine
Tarrawonga Coal, 2008B	Environmental Monitoring Program for the Tarrawonga Coal Mine
Tarrawonga Coal, 2009	Annual Environmental Monitoring Report for the Tarrawonga Coal Mine

DISCLAIMER

This report was prepared in accordance with the scope of services set out in the contract between Geoterra Pty Ltd (Geoterra) and the client, or where no contract has been finalised, the proposal agreed to by the client. To the best of our knowledge the report presented herein accurately reflects the client's intentions when it was printed. However, the application of conditions of approval or impacts of unanticipated future events could modify the outcomes described in this document.

The findings contained in this report are the result of discrete / specific methodologies used in accordance with normal practices and standards. To the best of our knowledge, they represent a reasonable interpretation of the general condition of the site / sites in question. Under no circumstances, however, can it be considered that these findings represent the actual state of the site / sites at all points. Should information become available regarding conditions at the site, Geoterra reserve the right to review the report in the context of the additional information.

In preparing this report, Geoterra has relied upon certain verbal information and documentation provided by the client and / or third parties. Geoterra did not attempt to independently verify the accuracy or completeness of that information. To the extent that the conclusions and recommendations in this report are based in whole or in part on such information, they are contingent on its validity. Geoterra assume no responsibility for any consequences arising from any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to Geoterra.

Interpretations and recommendations provided in this report are opinions provided for our Client's sole use in accordance with the specified brief. As such they do not necessarily address all aspects of water, soil or rock conditions on the subject site. The responsibility of Geoterra is solely to its client and it is not intended that this report be relied upon by any third party, who should make their own enquiries.

The advice herein relates only to this project and all results, conclusions and recommendations made should be reviewed by a competent and experienced person with experience in environmental and / or hydrological investigations before being used for any other purpose. The client should rely on its own knowledge and experience of local conditions in applying the interpretations contained herein.

To the extent permitted by law, Geoterra, excludes all warranties and representations relating to the report. Nothing in these terms will exclude, restrict or modify any condition, warranty, right or remedy implied or imposed by any statute or regulation to the extent that it cannot be lawfully excluded, restricted or modified. If any condition or warranty is implied into this license under a statute or regulation and cannot be excluded, the liability of Geoterra for a breach of the condition or warranty will be limited to the supply of the service again.

This report shall not be reproduced either wholly or in part without the prior written consent of Geoterra.

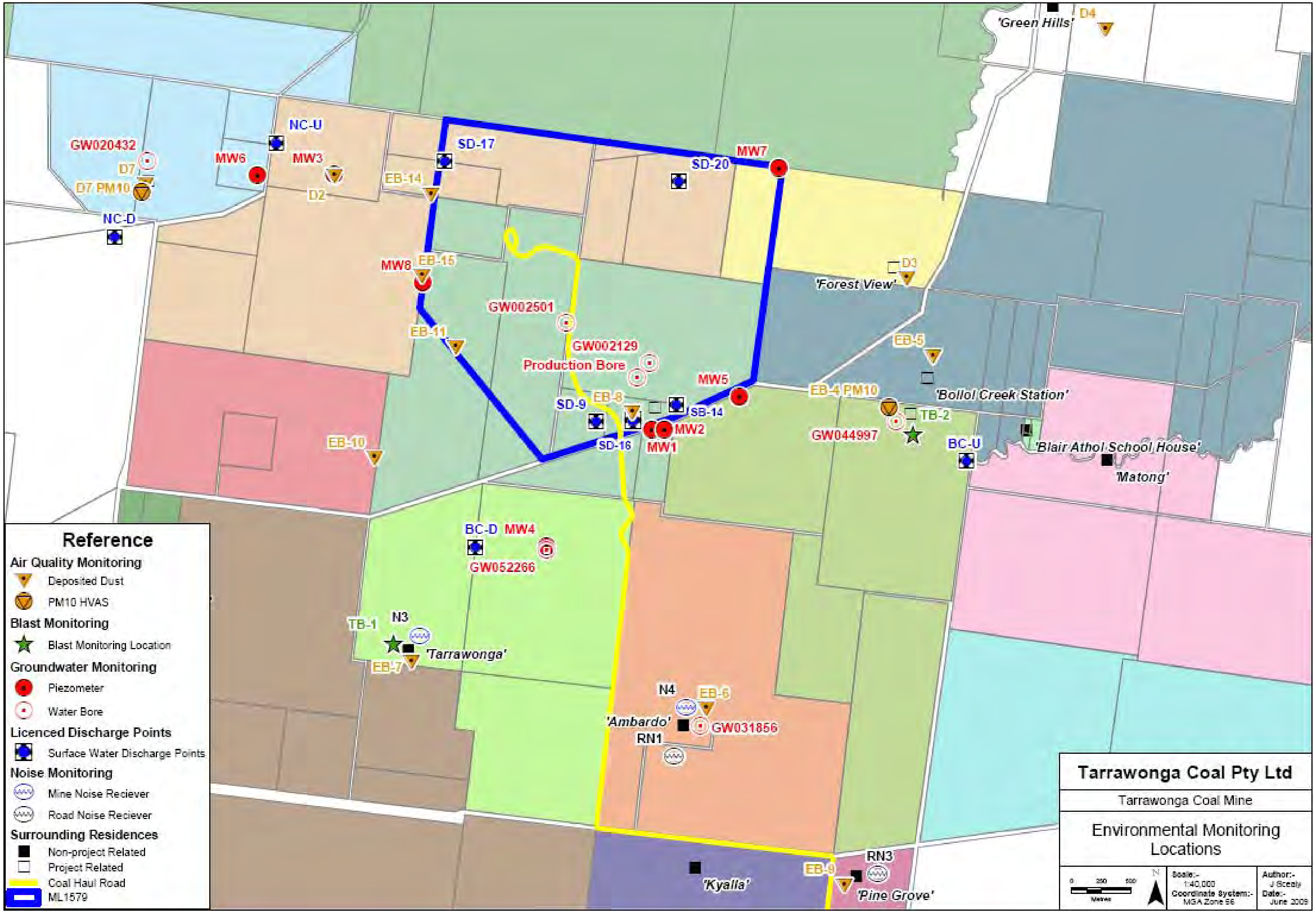

Figure 3 - Environmental Monitoring Locations

TARRAWONGA GROUNDWATER MONITORING SITES – SATELLITE IMAGE