

## Surface Water – Mining Area and Surrounds

Metropolitan Coal's Longwalls 20-22 underground mining area includes Waratah Rivulet and its tributaries (such as Tributaries A and B) and the Eastern Tributary and its tributaries (Figure 1). These streams flow directly to the Woronora Reservoir (Figure 1).

Metropolitan Coal's surface water monitoring program includes monitoring of:

- stream features;
- surface water flow;
- pool water levels;
- stream water quality; and
- reservoir water quality.

The monitoring results are described below.

### Stream Features

Visual and photographic surveys of streams are conducted to monitor changes to stream features (such as surface cracking and iron staining) as mining progresses.

A gas release from Pool H on the Waratah Rivulet was identified on 5 January 2011. The gas release is not an exceedance of Metropolitan Coal's performance measures which allow for 'minimal' gas release downstream of Pool P. There is no limit to gas release upstream of Pool P.

In accordance with the Longwalls 20-22 Water Management Plan, the following actions were undertaken once the gas release was identified:

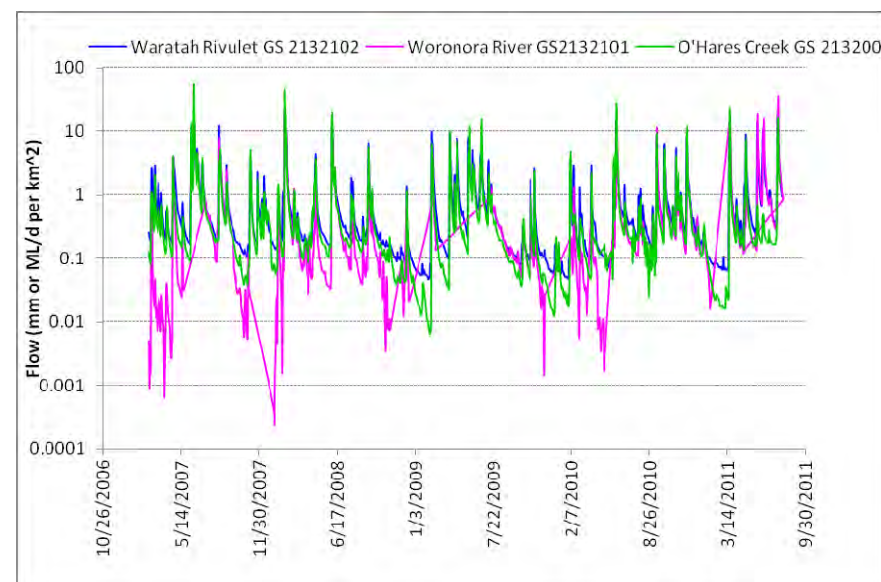
- monitoring conducted weekly to determine the extent of the gas releases,
- gas concentration monitoring (using OdaLog meter); and
- identification of any observable environmental effects (e.g. impacts to riparian vegetation or fish).

Gas releases were observed periodically until May 2011; however there were no observable environmental effects of these releases. There were no further indications of gas release from this time until the end of the review period.

### Surface Water Flow

Surface water flow monitoring includes continuous flow monitoring at the SCA-owned gauging stations on the Waratah Rivulet (GS2132102) and Woronora Reservoir (GS2132101) (Figure 2) and at the DECCW gauging station on O'Hares Creek at Wedderburn (GS213200).

Chart 1 shows concurrent streamflow data from the SCA-owned gauging stations on Waratah Rivulet and Woronora River and the OEH-owned gauging station on O'Hares Creek at Wedderburn. Streamflow is expressed on a per unit catchment area basis (in mm) to allow direct comparison of flow magnitudes without having to adjust for contributing catchment area.

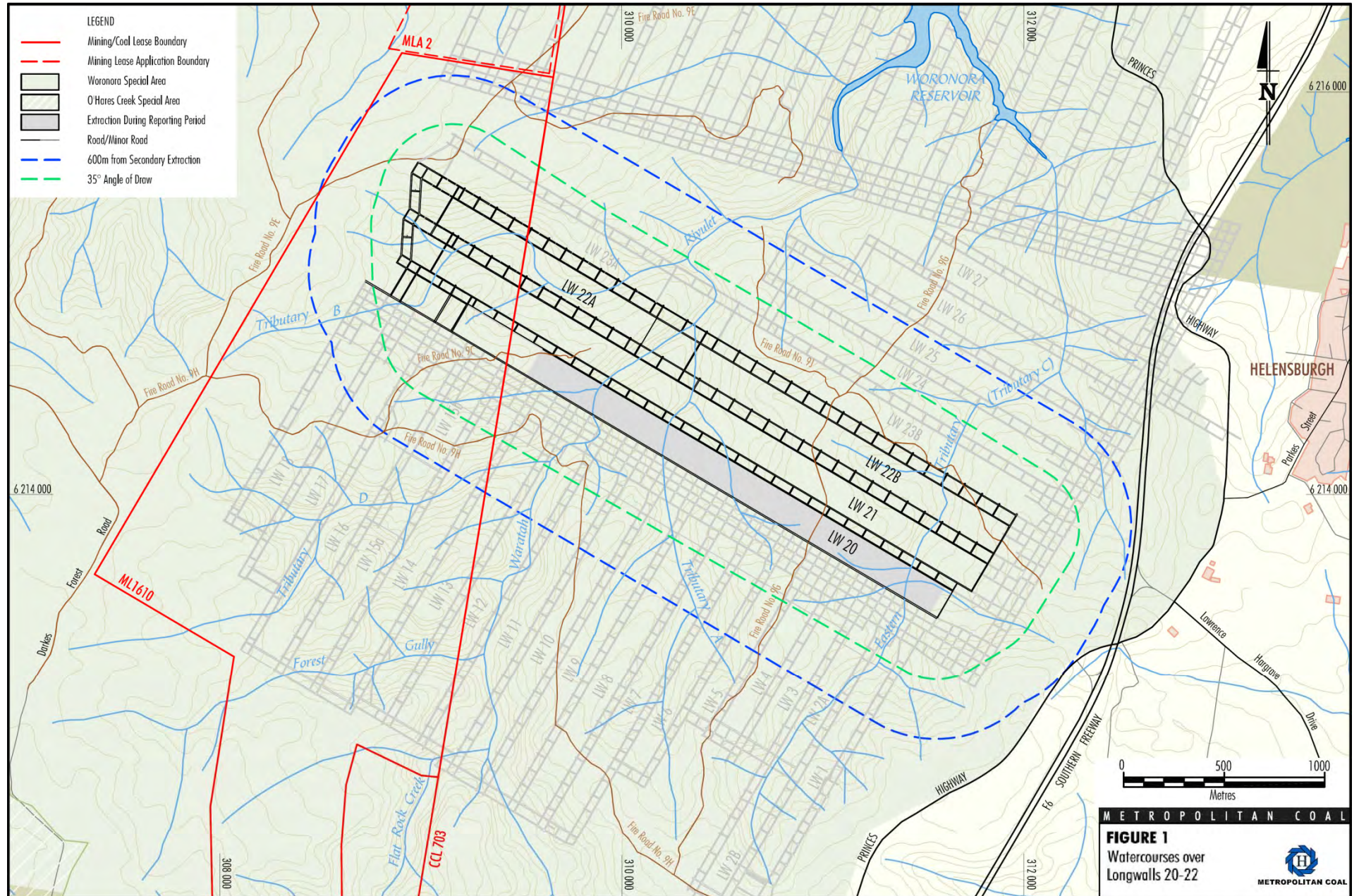


**Chart 1 Recorded Streamflow Hydrographs – Waratah Rivulet, Woronora River and O'Hares Creek at Wedderburn**

Of the three streams, Waratah Rivulet yielded the highest flow per unit catchment area in medium and low flows, with strong low flow persistence. O'Hares Creek (at Wedderburn) yielded similar flows, with slightly greater high flows, but notably steeper flow recession and lower magnitude low flows. The Woronora River recorded the lowest flows per unit catchment, with the steepest flow recessions.



# METROPOLITAN COAL - ENVIRONMENTAL MONITORING SUMMARY



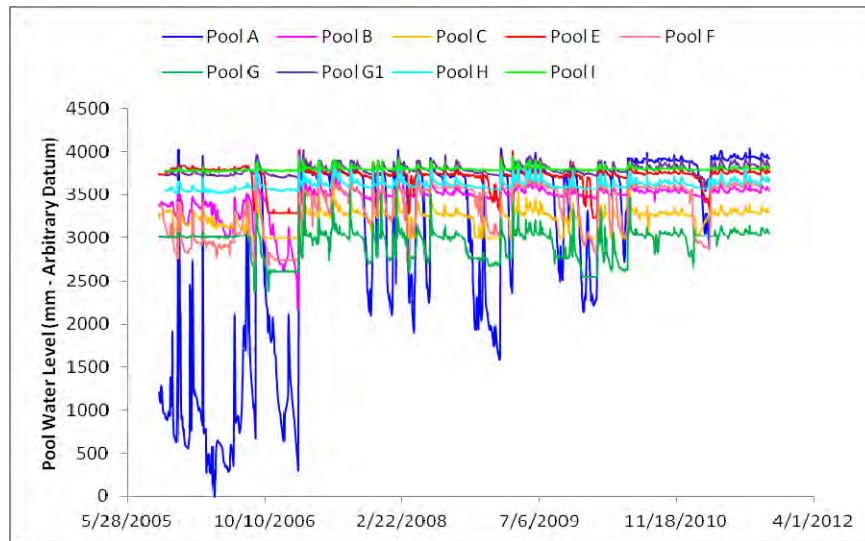


# METROPOLITAN COAL - ENVIRONMENTAL MONITORING SUMMARY

## Pool Water Levels

Water levels in a number of pools on the Waratah Rivulet, Eastern Tributary, Tributary B and Woronora River are manually monitored on a daily basis or by using a continuous water level sensor and logger.

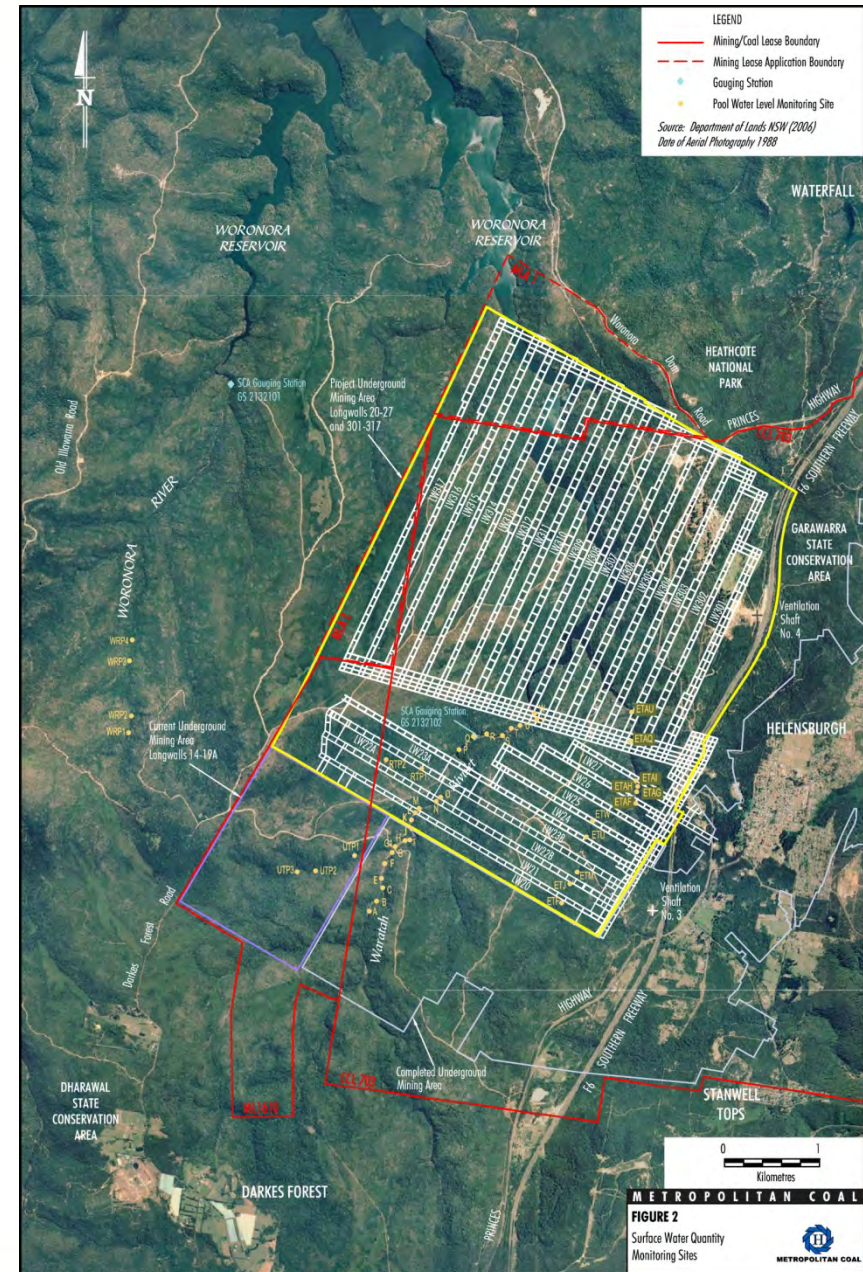
Pools A, B, C, E, F, G, G1, H and I on the Waratah Rivulet (Figure 2) are situated in the completed mining area (i.e. overlying Longwalls 1 to 13) between Flat Rock Swamp and Longwall 20. Pool water level monitoring of Pools A, B, C, E, F, G, G1, H and I are shown on Chart 2. As a result of previous mining, the water levels in pools upstream of Flat Rock Crossing (i.e. Pools A to G) have been impacted by mine subsidence. Stream remediation measures being implemented by Metropolitan Coal are discussed in the Rehabilitation section of this Environmental Monitoring Summary.



**Chart 2 Pool Water Levels in Pools A, B, C, E, F, G, G1, H and I**

Pool water level data is used to assess whether stream remediation measures are required and whether there has been any change in the natural drainage behaviour of pools downstream of maingate 23 (i.e. Pools P to W).

Pool G1 temporarily fell below its cease to flow level consistent with the predictions of the Project Environmental Assessment and that authorised by the Project Approval. Stream remediation activities will commence at Pools G/G1 following completion of remediation activities at Pool F.



**FIGURE 2**  
Surface Water Quantity  
Monitoring Sites



# METROPOLITAN COAL - ENVIRONMENTAL MONITORING SUMMARY

## Stream Water Quality

Surface water quality sampling is conducted monthly at a number of sites on Waratah Rivulet, Tributary B, Tributary D, Eastern Tributary, Far Eastern Tributary, Honeysuckle Creek, Bee Creek and the Woronora River.

Water quality parameters sampled include electrical conductivity, pH, redox potential, dissolved oxygen, turbidity, calcium, magnesium, sodium, potassium, chloride, sulphate, bicarbonate, total nitrogen, total phosphorus, nitrate, barium, strontium, manganese, iron, zinc, cobalt and aluminium. Samples collected for cation, anion and metal analysis are field filtered.

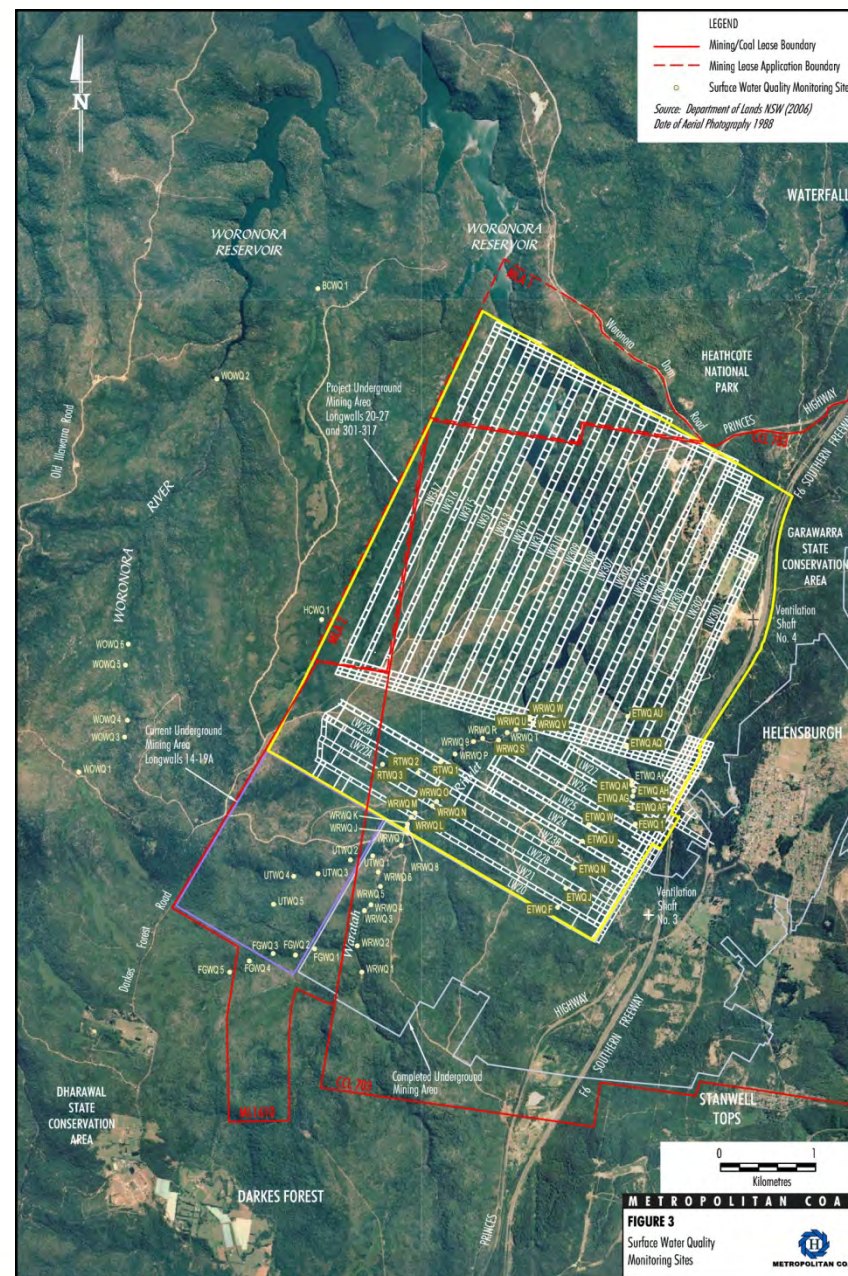
The results of key water quality parameters, namely pH, electrical conductivity, dissolved iron and dissolved manganese for a selection of sites (Woronora River control sites WOWQ 1, WOWQ 2 and WOWQ 4, Waratah Rivulet sites WRWQ 1, WRWQ 8 and WRWQ 9 and Eastern Tributary sites ETWQ F and ETWQ AU, Figure 3) are shown on Charts 3 to 6. Summary statistics from all locations are presented in Table 12.

**Table 1**  
**Surface Water Quality Summary**

Location	Eastern Tributary		Waratah Rivulet		Woronora River	
Parameter	Range	Average	Range	Average	Range	Average
pH (field)	4.69 – 7.92	6.5	4.79 – 8.14	6.5	2.42 – 7.35	5.75
Electrical Conductivity (field) (µS/cm)	47 – 310	175	103 – 306	200	0 – 245	175
Manganese (mg/L)	0.007 – 0.29	0.058	0.015 – 1	0.1	0.001 – 0.18	0.04
Iron (mg/L)	0.055 – 1	0.3	0.042 – 2.9	0.5	0.012 – 15	0.1
Aluminium (mg/L)	0.011 – 0.2	0.04	0 – 0.1	0.02	0 – 0.42	0.05*

*Note: Average does not include WOWQ 1. The average for WOWQ 1 was higher at ~0.2 mg/L*

Concentrations were relatively consistent between the sites with all watercourses experiencing spikes or pulses throughout the time series. The Waratah Rivulet appeared to have higher Manganese concentrations and the Woronora River higher Aluminium concentrations. Analysis of the raw data for all monitoring sites demonstrates that the overall water quality of most indicator parameters has not been noticeably affected by mining.





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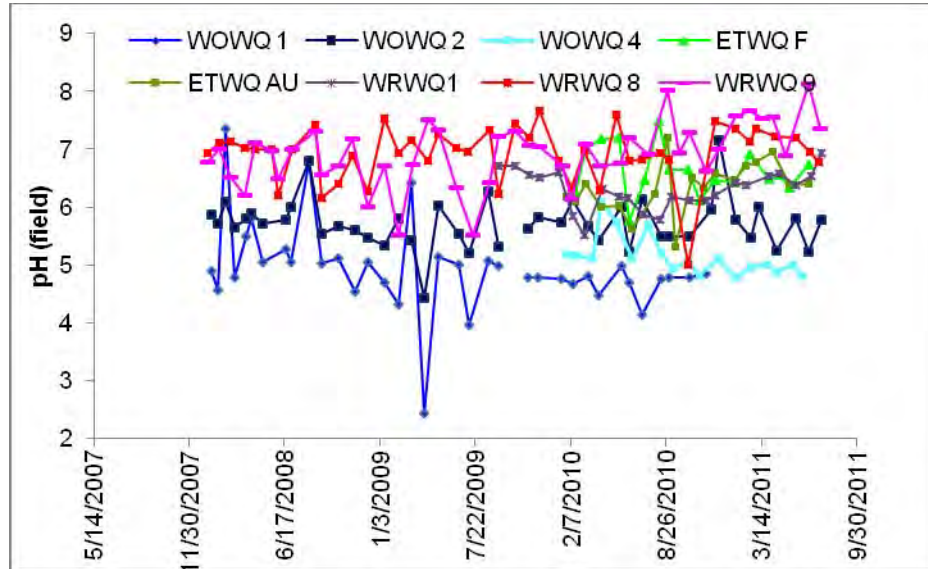


Chart 3 pH

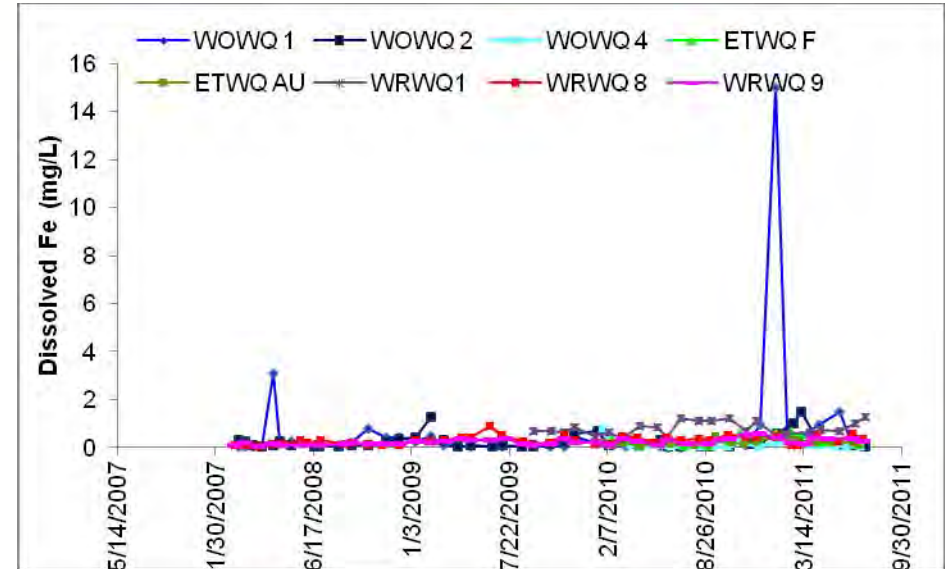


Chart 5 Dissolved Iron Concentrations

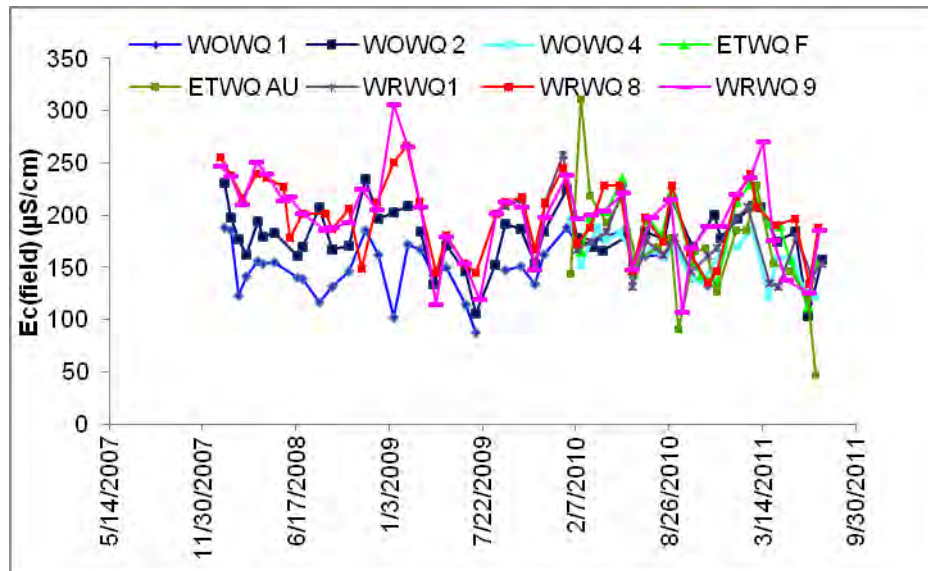


Chart 4 Electrical Conductivity

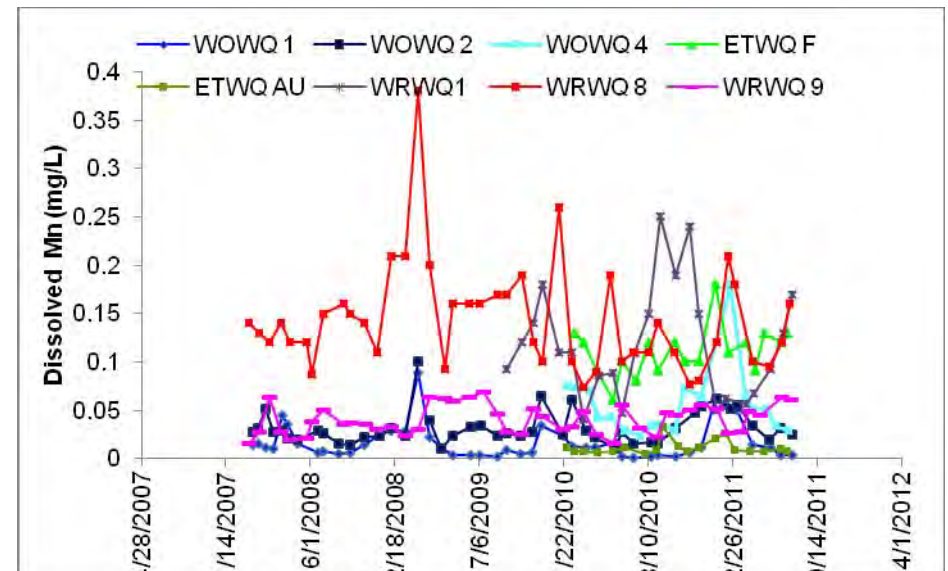


Chart 6 Dissolved Manganese Concentrations

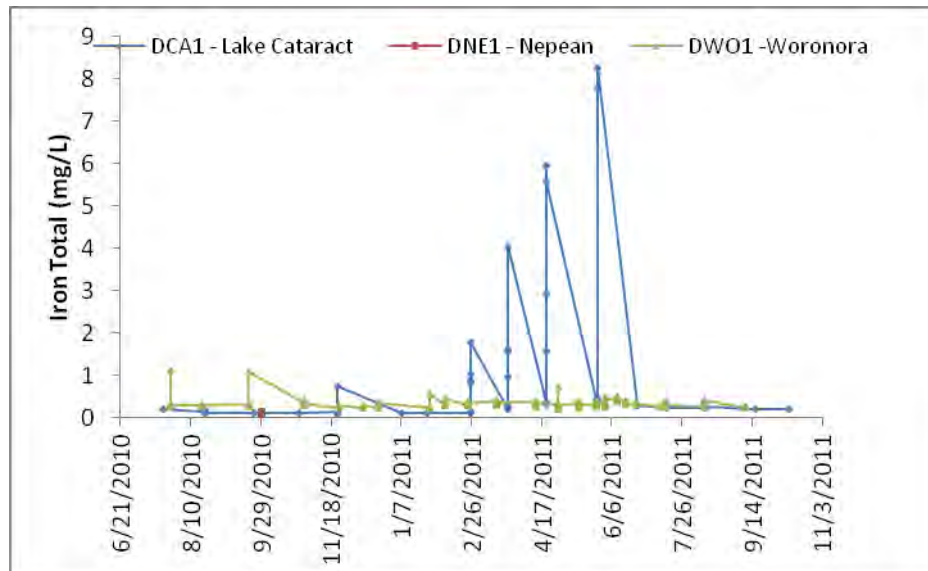
# METROPOLITAN COAL - ENVIRONMENTAL MONITORING SUMMARY

## Woronora and Nepean Reservoir Water Quality

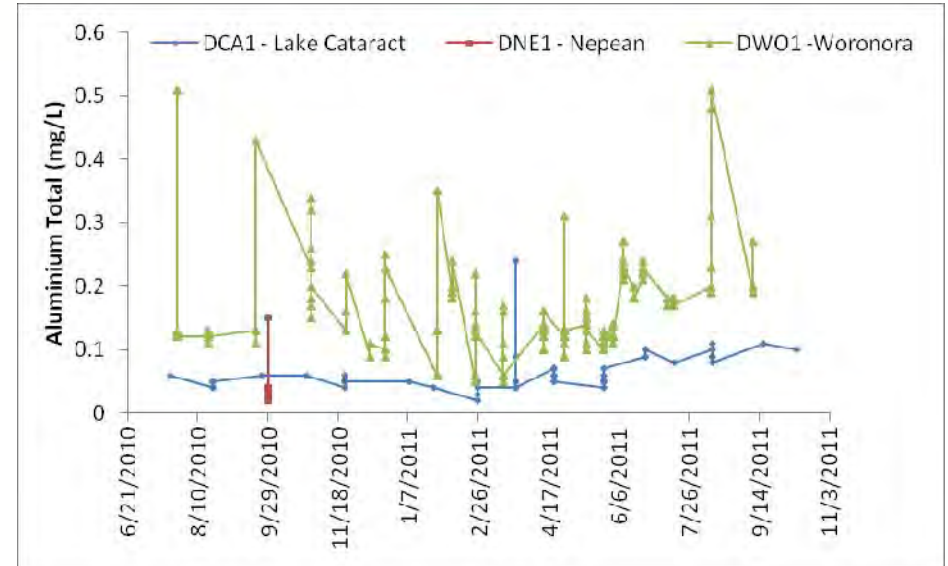
Metropolitan Coal sources surface water quality data for the Woronora Reservoir (site DW01, measurements taken from 0 to 9 m below the water surface level) Lake Cataract (site DCA1) and Nepean Reservoir (DNE1) from the SCA in accordance with a data exchange agreement.

Charts 7 to 9 show the water quality results for total iron, aluminium and manganese at sites DCA1 (Lake Cataract), DNE1 (Nepean Reservoir) and DW01 (Woronora Reservoir).

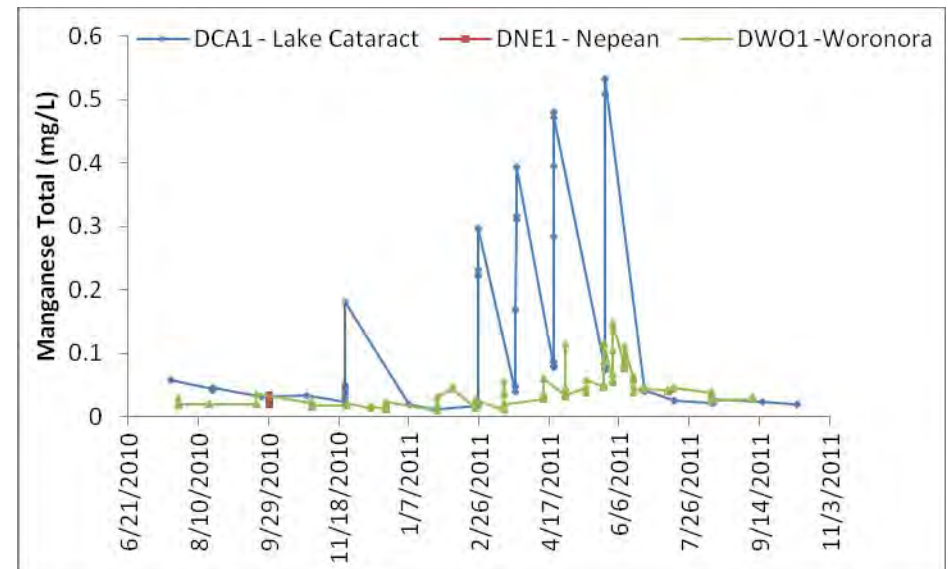
The data show that total iron and total manganese have been higher in Lake Cataract than in Woronora Reservoir whilst the opposite is true for total aluminium. There is no visual evidence of a trend in either Woronora Reservoir or Lake Cataract in any of these parameters over the period of available data.



**Chart 7** Lake Cataract, Nepean Reservoir and Woronora Reservoir Iron Concentrations



**Chart 8** Lake Cataract, Nepean Reservoir and Woronora Reservoir Aluminium Concentrations



**Chart 9** Lake Cataract, Nepean Reservoir and Woronora Reservoir Manganese Concentrations