10 December 2019

Paul Freeman
A/Director
Resource Assessments
Department of Planning, Industry & Environment
Via email: Paul.Freeman@planning.nsw.gov.au

Dear Paul,

RE: METROPOLITAN COAL – REVIEW OF GEOTECHNICAL AND WATER ASPECTS OF THE LONGWALLS 305-307 EXTRACTION PLAN

INTRODUCTION

The Woronora Reservoir Impact Strategy (WRIS) investigation and reports for the Metropolitan Mine were initiated by the Department of Planning and Environment as an approval condition of the Metropolitan Coal Longwalls 301-303 Extraction Plan. The WRIS Panel was established on 24 May 2017, with the following members appointed:

- Professor Bruce Hebblewhite, private mining/geotechnical consultant, and Chair of Mining Engineering, School of Mining Engineering (now the School of Minerals and Energy Resources Engineering), University of New South Wales to deal with the geotechnical aspects;
- Professor Emeritus Tom McMahon, Department of Infrastructure Engineering, University of Melbourne to deal with surface water aspects; and
- Dr Frans Kalf of Kalf and Associates Pty Ltd, a hydrogeologist and a specialist numerical modelling developer and consultant in both government and private industry to deal with the groundwater issues.

On 9 October 2019, Metropolitan Coal submitted an Extraction Plan to the Department of Planning, Industry & Environment seeking approval for secondary extraction of coal from Longwalls (LW) 305 to 307 at the Metropolitan Mine. The WRIS Panel has been asked to provide review comments on the geotechnical and water components of the Longwalls 305-307 Extraction Plan, that relate to Metropolitan Coal's Subsidence Impact Performance Measures for the Woronora Reservoir. These Performance Measures are reproduced below:

Catchment yield to the Woronora Reservoir	*Negligible reduction to the quality or quantity of water resources reaching the Woronora Reservoir* *No connective cracking between the surface and the mine*
Woronora Reservoir	*Negligible leakage from the Woronora Reservoir* *Negligible reduction in the water quality of Woronora Reservoir*

The WRIS Panel has considered the following documents of the Longwalls 305-307 Extraction Plan (dated October 2019) as part of its review:

- Metropolitan Coal Longwalls 305-307 Extraction Plan – Main Text;
- Metropolitan Coal Longwalls 305-307 Extraction Plan – Water Management Plan (main text only);
- Metropolitan Coal Longwalls 305-307 Extraction Plan – Subsidence Monitoring Program; and
- Metropolitan Coal Longwalls 305-307 Extraction Plan – Subsidence Report.

A summary of our review comments is provided below.

Overview of Proposed Longwalls 305-307 Extraction Plan

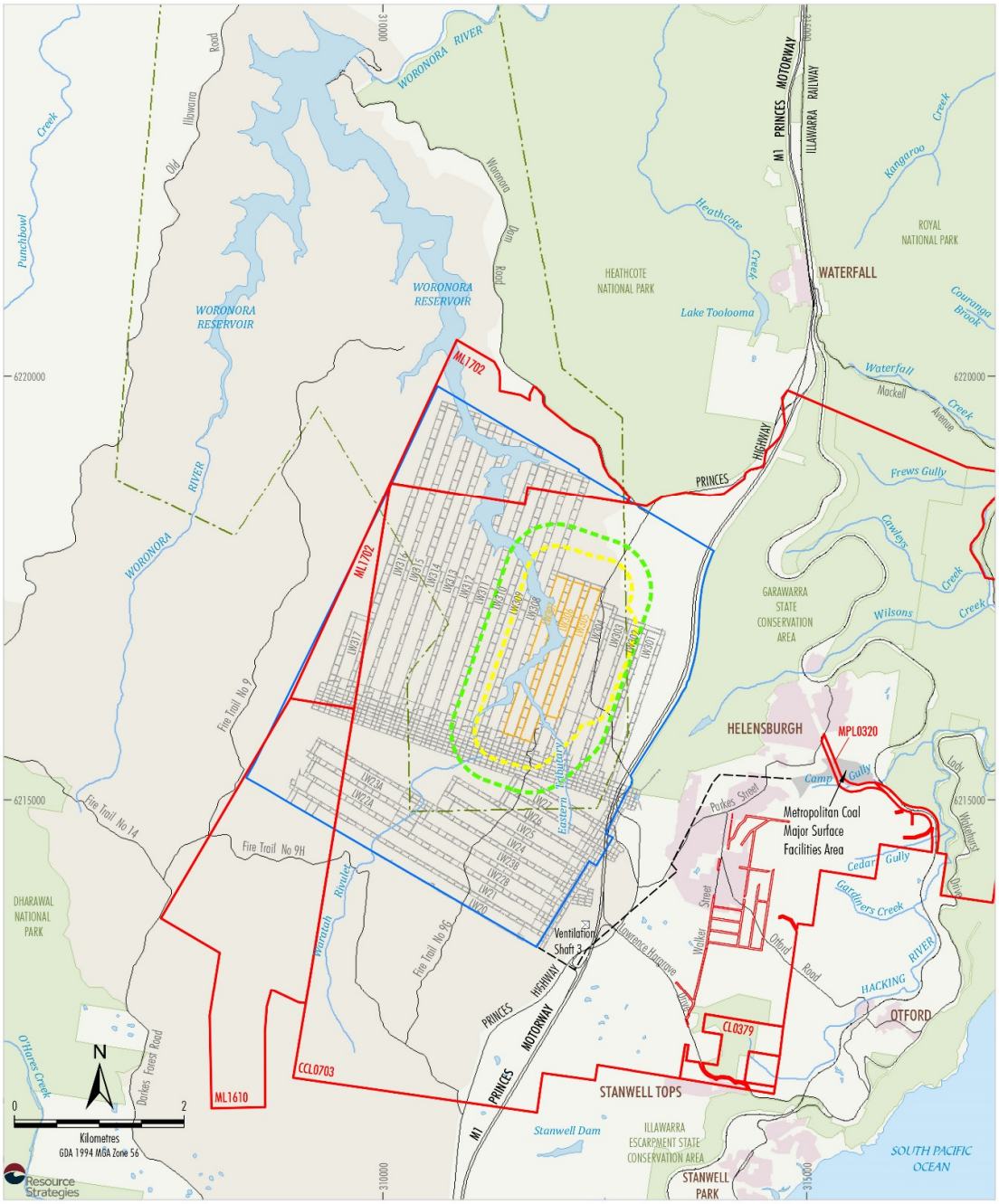
The Longwalls 305-307 Extraction Plan was prepared by Metropolitan Coal, with assistance from Mine Subsidence Engineering Consultants (MSEC), SLR Consulting, Hydro Engineering & Consulting, The University of Queensland, Cenwest Environmental Services, Ecoplanning, Niche Environment and Heritage, and Resource Strategies. The Extraction Plan outlines the proposed management of potential subsidence effects, subsidence impacts and environmental consequences in the Project underground mining area during the secondary extraction of LW305-307 at Metropolitan Coal. The Extraction Plan area for LW305-307, based on a 35 degree (°) angle of draw and/or predicted 20 millimetre subsidence contour, is shown on Figures 1 and 2.

A summary of the longwall dimensions and mining parameters for LW305-307 is provided in Table 1. The LW305 layout includes a 138 m panel width (void), a 45 m tailgate pillar width and a 70 m maingate pillar width. The layout of LW306 and 307 includes 138 m panel widths (void) and 70 m pillars (solid) consistent with the Preferred Project Layout.

Table 1
Key Mining Parameters

Parameter	Longwalls 305-307
Gate Road Width (m)	5.2
Gate Road Height (m)	3.2
Maingate Chain Pillar Width (m)	70
Tailgate Chain Pillar Width (m)	45 (LW305), 70 (LW306 and LW307)
Longwall Void Width (m) (ribline of goaf edge)	138
Longwall Void Length (m)	1,596 (LW305), 1,956 (LW306), 1,956 (LW307)
Seam Thickness (m)	2.6 – 2.9
Extraction Height (m)	Up to 3.2
Depth of Cover (m)	410 – 535

The Extraction Plan Layout includes the first of the 300 series longwalls proposed to extend beneath the Woronora Reservoir full supply level, namely LW306 and 307. LW305 does not extend beneath the full supply level of the Woronora Reservoir.



LEGEND

- Mining Lease Boundary
- Woronora Special Area
- Railway
- Project Underground Mining Area Longwalls 20-27 and 301-317
- Longwalls 305-307 Secondary Extraction
- Longwalls 305-307 35° Angle of Draw and/or Predicted 20 mm Subsidence Contour
- 600 m from Longwalls 305-307 Secondary Extraction
- Woronora Notification Area
- Existing Underground Access Drive (Main Drift)

Source: Land and Property Information (2015); Department of Industry (2015); Metropolitan Coal (2019); MSEC (2019)

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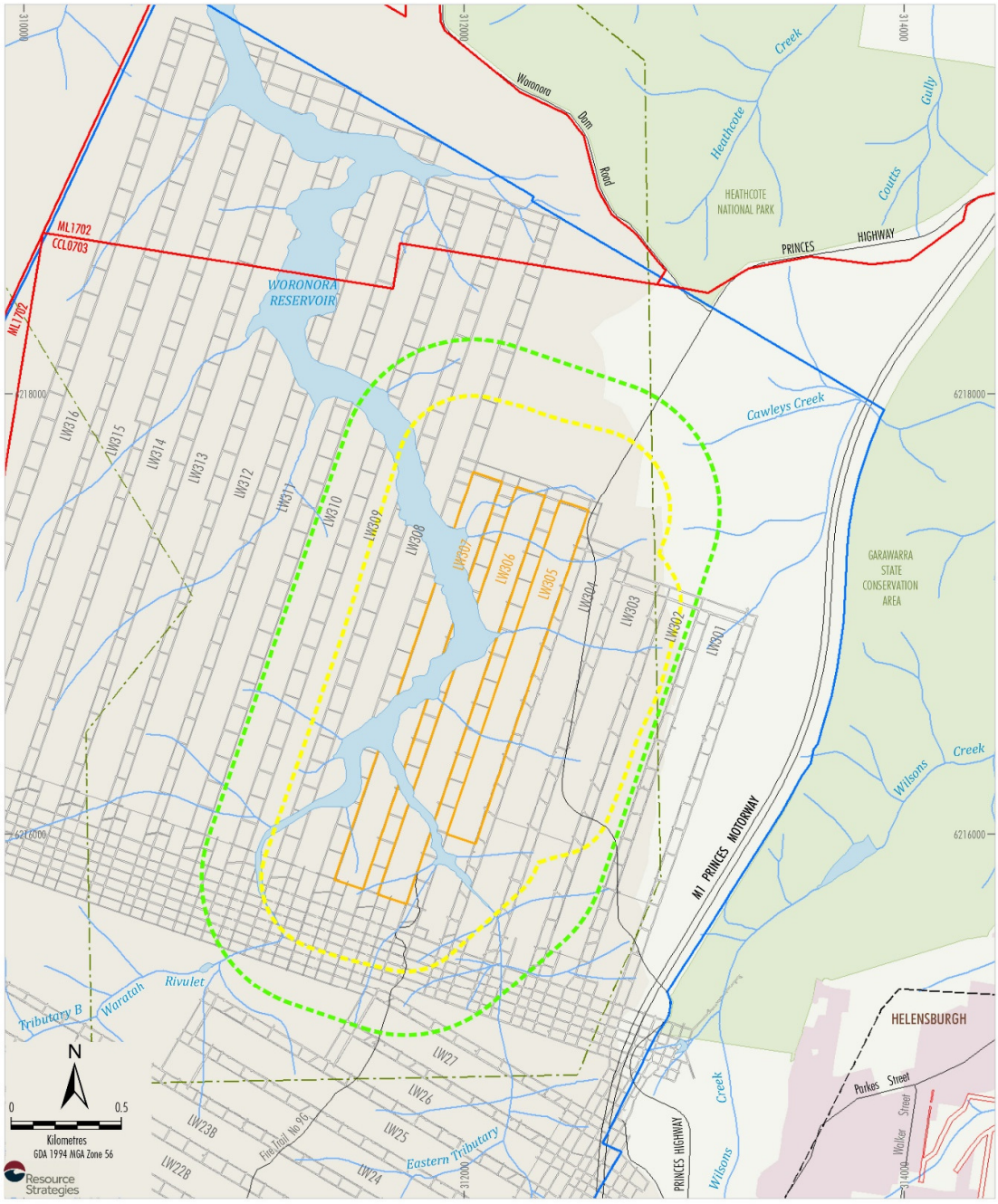
Longwalls 305-307 and Project Underground Mining Area

Figure 1



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Longwalls 305-307 Layout

Figure 2

Geotechnical and Subsidence Predictions

The subsidence prediction techniques developed and adopted by MSEC represent a state-of-the-art methodology which has been developed using an extensive subsidence monitoring database – particularly based on the Southern Coalfield of NSW, including Metropolitan Coal. MSEC has reviewed their initial predictions prior to LW301 and LW302 and produced a revised calibration for future longwall panels at Metropolitan. The predictions for LW305 – LW307 are therefore considered to be of a high level of accuracy and reliability for the overall subsidence parameters across the region. The predictions clearly demonstrate the significantly reduced subsidence impacts resulting from the modified longwall panel dimensions for mining beneath the Woronora Reservoir.

The proposed monitoring program is based on a continuation of the successful monitoring regime adopted since LW301. The program has incorporated a number of the recommended features identified in the WRIS Reports. An important aspect of all of the monitoring parameters is the need to establish early baseline data while monitoring locations are sufficiently distant from active mining to ensure that a good pre-mining set of baseline data is established. This approach must be continued and include the establishment of reliable data on the far side of the Woronora Reservoir (and across the reservoir valley), prior to commencement of LW305.

In relation to specific areas of impact, the monitoring approach that has previously been adopted for the Eastern Tributary rock bars during mining of LW303 and 304 are commended, and such an approach should be continued in appropriate locations for LW305 to LW307.

The Stage 2 WRIS Report recommended that a number of particular aspects of monitoring be included as mining progresses beneath the Woronora Reservoir. This included an expanded program of GNSS (3D real-time) monitoring on both sides of the reservoir. This appears to be included in the proposed monitoring, although as experience develops, there could be scope for more GNSS sites to be established in critical locations.

The Stage 2 WRIS report also specifically recommended the installation of some high precision valley closure survey lines (same style as Eastern Tributary) across the valley floor in critical locations (subject to appropriate access, line of sight and other logistical restrictions). It is strongly recommended that these additional lines be added into the proposed monitoring program. Furthermore, it would be useful, where practicable, to include a GNSS station at one end of each of the high precision lines to enable an absolute fix for the source of any valley closure detected.

A further recommendation of the WRIS Stage 2 Report was greater use of LIDAR surveys within the Woronora Reservoir valley areas – especially to capitalise on the current low water levels. A program of LIDAR surveying should be included in the proposed monitoring program.

One final comment in relation to geotechnical/subsidence monitoring relates to subsidence impacts caused by fault structures. Figure 4 of the Longwall 305 – 307 Extraction Plan – Main Text showed a number of faults detected in the region of LW305 and LW306 (and also impacting the current LW304). The LW305 – 307 Extraction Plan - Subsidence Report (Section 1.5) discusses these faults but makes no further comment on their impact on either subsidence predictions or current subsidence behavior detected by monitoring results.

It is understood that such impacts are expected to be minor, but it would be useful if MSEC could provide a brief commentary on the experience during the mining of LW304 with respect to the fault that runs the length of the panel (F-0008), as to whether any impacts or anomalous behaviour has been detected. It would also be useful to comment on whether the future predictions have made any provisions for such anomalous behavior above LW305 and LW306 – if such behaviour has been detected.

In relation to subsidence monitoring, it would be valuable to focus some additional monitoring attention on points on either side of the fault region, where fault F-0027 crosses the base of the Woronora Reservoir beneath LW305, in order to gain a better understanding of the mining-induced impacts on such structures, particularly where they cross a valley floor.

Water Management

The proposed monitoring for water management to be undertaken during mining of LW305-307 is an extension of the monitoring underway during LW304. The key performance measures include:

- Negligible reduction to the quantity of water resources reaching the Woronora Reservoir,
- Negligible reduction to the quality of water resources reaching the Woronora Reservoir,
- No connective cracking between the surface and the mine,
- Negligible leakage from the Woronora Reservoir,
- Negligible reduction in the water quality of Woronora Reservoir,
- Negligible environmental consequences on the Waratah Rivulet between the full supply level of the Woronora Reservoir and the maingate of Longwall 23, and
- Negligible environmental consequences over at least 70% of the stream length of the Eastern Tributary between the full supply level of the Woronora Reservoir and the maingate of Longwall 26.

To ensure these performance measures are achieved, the monitoring program as listed in Table 17 of the Longwalls 305-307 Main Text is endorsed by the WRIS Panel. The program addresses the following monitoring components:

- Stream features,
- Surface water flow,
- Pool water levels and drainage behaviour,
- Stream water quality,
- Woronora, Nepean and Cataract water quality,
- Shallow groundwater levels near streams,
- Groundwater levels/pressures,
- Groundwater quality, and
- Mine water make.

The elements of the surface water program are a continuation of the program implemented for monitoring during LW304 which additionally included the monitoring of two sub-catchments, I and K, to the west of LW301-303 and a pluviograph in the vicinity of the northern end of LW307 which together address recommendations in the WRIS Stage 1 report.

Groundwater piezometers which are indirectly monitoring LW304, are continuing. While it would desirable to establish deep monitoring piezometers within the central parts of LW 305, LW 306 and LW307 as well as the shallow piezometers, this is not possible because of site access due to the steep topography. Nevertheless, the WRIS Panel is satisfied that the type, the extent and the frequency of surface and groundwater monitoring detailed in WMP are sufficiently detailed to assess during LW305 - 307 the performance measures noted above. We also consider the TARPs which are listed in Tables 23 to 25 in the WSP are of sufficient detail to ensure that any adverse effects relating to performance measures will be quickly identified.

Summary

The WRIS Panel has reviewed the Water Management Plan, Subsidence Report and Subsidence Monitoring Program of the Longwalls 305-307 Extraction Plan. The documents reviewed have been prepared with the assistance of suitably qualified and experienced experts and provide an overview of the subsidence impacts, environmental consequences and proposed monitoring and management regime associated with the secondary extraction of LW305-307 at Metropolitan Coal.

The WRIS Panel has been involved with the preparation of two reports relating to the investigation of mining near and beneath the Woronora Reservoir. Based on the review of available data, analytical predictions and monitoring bore evidence at LW302, together with the use of narrower panels and wider chain pillars beneath the reservoir, the proposed longwall mining is not expected to result in connective cracking between the longwalls and surface or inflows from Woronora Reservoir to the mine extraction zone.

The WRIS Panel is of the opinion that proposed monitoring technologies outlined in the Water Management Plan and Subsidence Monitoring Program are both reasonable and appropriate to assess Metropolitan Coal's performance against Performance Measures relating to the Woronora Reservoir. It is recommended that some additional monitoring be included to supplement the proposed program, as discussed above – including high precision valley closure lines; some targeted additional GNSS survey stations and a program of LIDAR monitoring.

Please do not hesitate to contact the WRIS Panel should you have any queries.

Yours sincerely,

Signed on behalf of:
Bruce Hebblewhite Thomas McMahon Frans Kalf