Nebo Area – Longwall N4: End of Panel Report (Ecology)

FINAL REPORT

Prepared for Wongawilli Coal Pty Ltd

15 December 2017

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- Wongawilli Coal: Kamlesh Prajapati

Biosis staff involved in this project were:

- Lauren Harley (mapping)

Contents

Tables

Figures

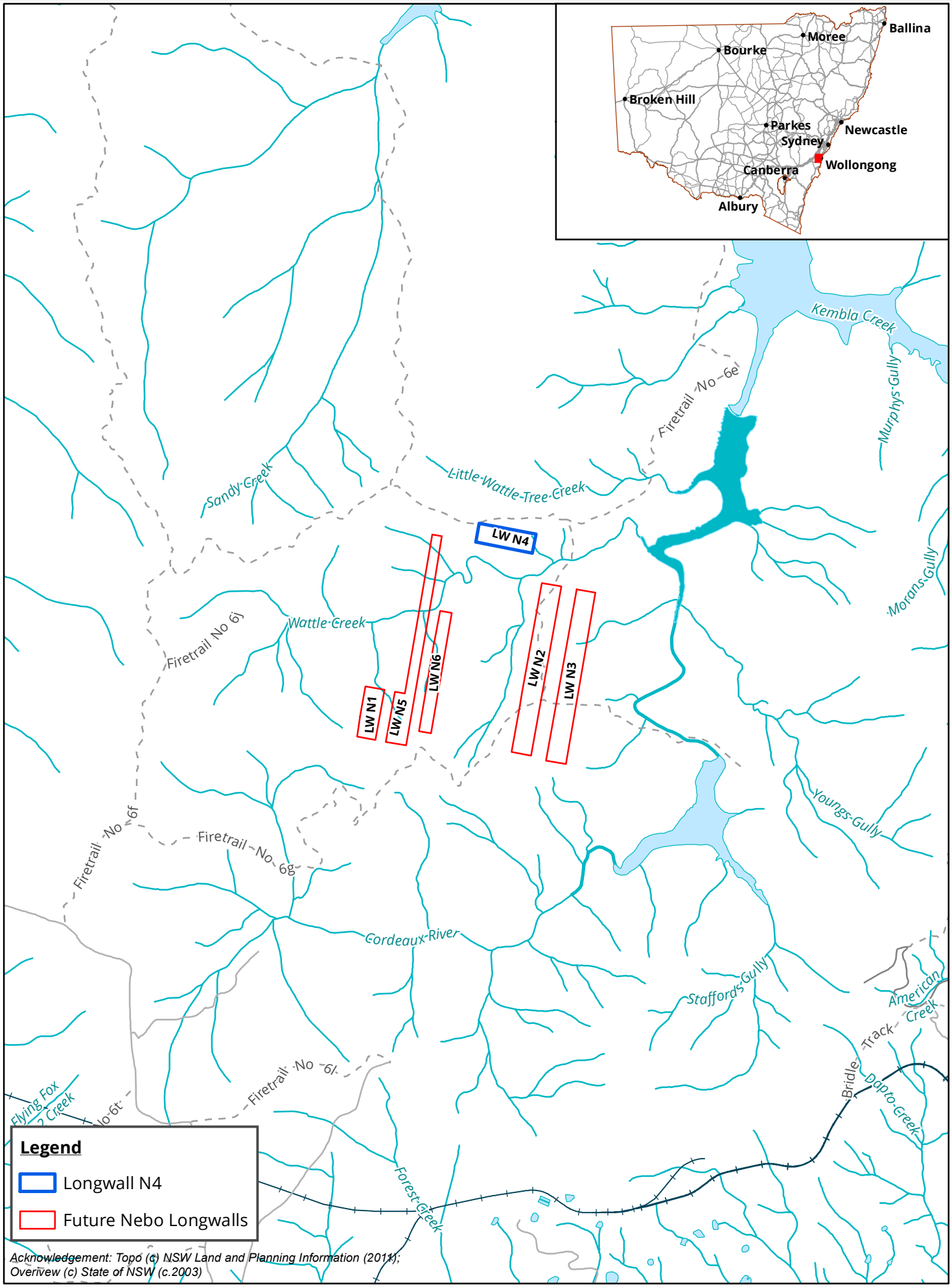
1 Introduction

Biosis Pty Ltd (Biosis) was commissioned by Wollongong Coal Ltd (WCL) to undertake an End of Panel assessment of potential impacts from extraction of Longwall N4 in the Nebo Area at Wongawilli Colliery. This report assesses the post mining conditions in relation to terrestrial and aquatic ecology within the area potentially impacted by subsidence effects associated with mining of Longwall N4 (Figure 1).

Extraction of secondary workings was completed between August 2016 and May 2017. The full longwall panel length was extracted. Figure 1 illustrates both the initial estimated extraction area for Longwall N2 and the completed extraction area.

This report has been prepared in accordance with Subsidence Management Plan Approval 09/5341 (Condition 18) (DTIRIS, 2013) and includes:

- An outline of monitoring programs conducted to date.
- An assessment of the results of monitoring undertaken to date.
- A comparison of observed impacts versus those predicted to occur.
- An assessment of whether any actions outlined in the Trigger Action Response Plan (TARP) have been triggered.
- Conclusions on impacts to ecology resulting from the extraction of Longwall N2, as well as cumulative impacts from longwall mining in the Nebo Area.



Acknowledgement: Topo (c) NSW Land and Planning Information (2011); Overview (c) State of NSW (c.2003)

Figure 1: Longwall N4, Nebo Area

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Matter: 25100
Date: 24 July 2017,
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0 0.3 0.6 0.9 1.2
Kilometers

N

Scale 1:30,000 @ A4, GDA 1994 MGA Zone 56

2 Monitoring programs

The ecological monitoring programs for the Nebo Area are detailed within the Nebo Longwalls N1-N6 Subsidence Monitoring Plan (NRE, 2014), Nebo Longwalls N1-N6 Extraction Plan (Chapter 8: Biodiversity Management Plan) (Niche, 2012) and the Nebo Area Environmental Assessment (ERM, 2010). These documents outline the biodiversity monitoring actions that are required to satisfy on-going conditions of approval as detailed within the Nebo Longwalls N1-N6 Subsidence Management Plan Approval (DTIRIS, 2013) and NRE Wongawilli Colliery – Nebo Area Project Approval (MP09_0161).

Ecological monitoring to date within the Nebo Area has been completed within the requirements set out in Niche (2012) and summarized in Appendix 1: Tables 4- 6. Details of the terrestrial and aquatic monitoring programs are provided below.

2.1 Terrestrial ecology monitoring program

The terrestrial ecological monitoring program for Longwalls N1- N6 conducts annual surveys at impact and control sites shown in Figure 2and Figure 3, including:

- Flora monitoring:
  - Riparian vegetation monitoring conducted at two creek line impact sites and two control sites. Each creekline site contains three quadrat locations.
  - Photo point monitoring at each creek monitoring site (control and impact).
- Fauna monitoring:
  - Nocturnal frog monitoring conducted at two creek line impact sites and two control sites.

There are no significant swamps, threatened frog habitat (Biosis, 2014) or ridgeline features in the vicinity of Longwall N4.

The terrestrial ecology monitoring program is scheduled to be conducted for a minimum of two year's pre-mining, during mining and a minimum of one year post mining.

The terrestrial ecological monitoring programs employ a Before-After Control-Impact (BACI) design, comparing sites pre- and post-mining and comparing sites that have been mined beneath (impact sites) with sites that have not been mined beneath (control sites).

2.1.1 Monitoring to Date

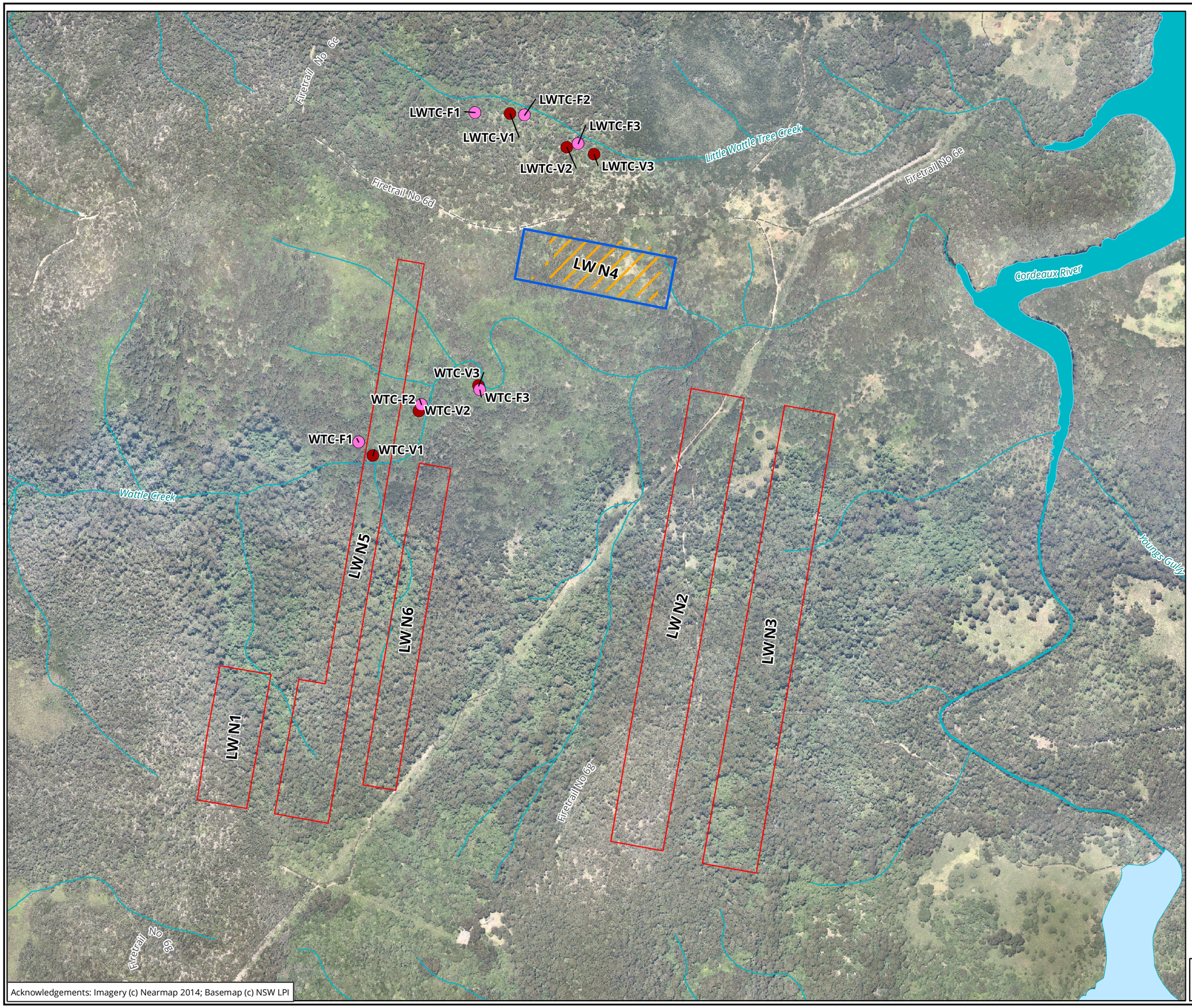
Terrestrial monitoring within the Nebo area, including collection of baseline data, commenced in December 2010. Monitoring was undertaken until autumn 2014, then suspended after mining of N2 was stopped in February 2014. Monitoring recommenced in spring 2015 (September for Control sites and October for Impact sites) and has continued to date (Autumn 2017).

In total four years of baseline data has been collected prior to mining, including six months collected prior to the extraction of N4.

The terrestrial monitoring program, including monitoring type, sites, site type and methodology, is outlined in Table 1.

Table 1 Terrestrial ecology monitoring program

Monitoring	Impact Sites (Figure 2)	Control Sites (Figure 3)	Methodology
Riparian Vegetation	Wattle Tree Creek Little Wattle Tree Creek	Flying Fox Creek Morans Gully	Vegetation surveys within creeks are undertaken at three 20m x 20m (400m^2) quadrats per creek located at least 150m apart. Within each quadrat, subjective cover abundance scores are given to each species occurring within the quadrat using a modified Braun-Blanquet scale. Where there is potential for misidentification, or where species cannot be reliably identified to species level in the field, species have been grouped into identification units for analysis. Each of these units is referred to as a species complex. Surveys are undertaken once in spring and once in autumn each year.
Frogs – Point Surveys	Wattle Tree Creek Little Wattle Tree Creek	Flying Fox Creek Morans Gully	Nocturnal frog surveys within creeks are undertaken at three 50m long transects per creek located at least 150m apart. Transects are surveyed by walking down the creek and counting all frogs seen or heard. Counts of tadpoles and egg mass are also undertaken where present.



Legend

Flora Monitoring

- Flora creek impact site

Fauna Monitoring

- Fauna creek impact site

Survey Area

- Future Nebo Longwalls
- Longwall N4
- Extent mined

Figure 2: Terrestrial ecology monitoring impact sites

0 80 160 240 320 400

Metres

Scale: 1:8,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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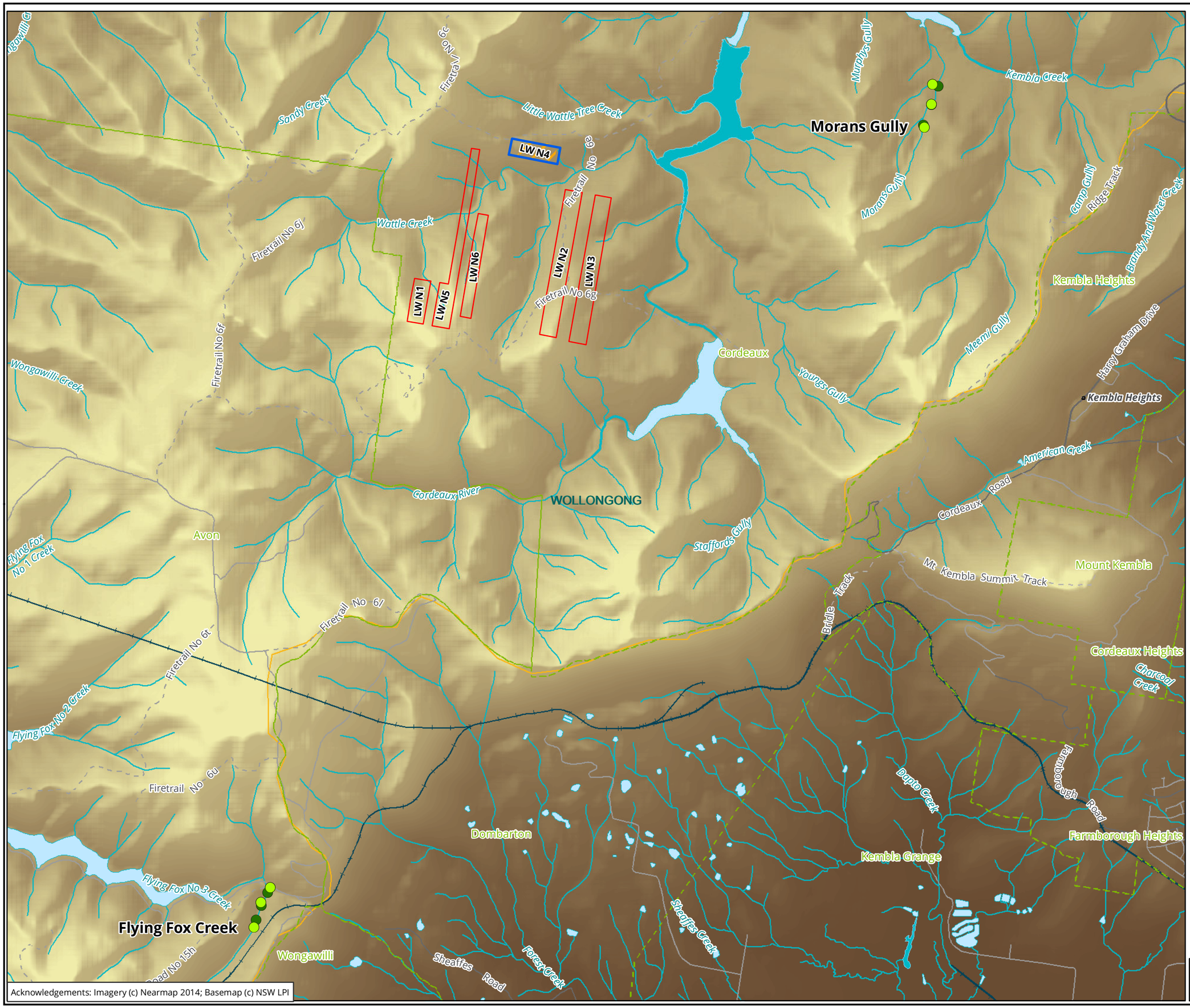
25100_F2_EcoImpactMonitoring

Acknowledgements: Imagery (c) Nearmap 2014; Basemap (c) NSW LPI



Legend

Flora Monitoring

- Flora creek control site

Fauna Monitoring

- Fauna creek control site

Survey Area

- Future Nebo Longwalls
- Longwall N4
- Extent mined

Figure 3: Terrestrial ecology monitoring control sites

0 250 500 750 1,000 1,250

Metres

Scale: 1:25,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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2.2 Aquatic ecology monitoring program

The aquatic ecology monitoring program for Longwalls N1-6 is undertaken at eight impact sites and four control sites, monitored during spring and autumn (Figure 4), including:

- Aquatic habitat monitoring, including surface water quality monitoring.
- Monitoring of aquatic macroinvertebrates (AUSRIVAS).
- Photo point monitoring.

The aquatic ecology monitoring program is required to be conducted for a minimum of two year's pre-mining, during mining and a minimum of one year post mining.

The aquatic ecological monitoring programs employ a Before-After Control-Impact (BACI) design, comparing sites pre- and post- mining and comparing sites that have been mined beneath (impact sites) with sites that have not been mined beneath (control sites).

2.2.1 Monitoring to Date

The mine complex at Nebo includes longwalls (N1, N2, N3, N4, N5 and N6) that are situated beneath the catchments of Wattle Creek and Little Wattle Tree Creek within the greater catchment of Lake Cordeaux. Mining operations in Longwall N4, commenced in August 2016 and ceased in May 2017.

Aquatic ecological monitoring in the Nebo lease area commenced in autumn 2011 to collect pre-mining monitoring data, which included the assessment of four control sites. The aquatic ecological monitoring has continued through to spring 2016. In total five years of baseline data has been collected prior to mining, with the monitoring program continuing through to Spring 2017.

Details of the aquatic monitoring program, including monitoring type, monitoring reaches, and methodology, area provided in Table 2.

Table 2 Aquatic ecology monitoring program

Monitoring	Impact Reaches (Figure 4)	Control Reaches (Figure 4)	Methodology
Aquatic Habitat monitoring including surface water quality monitoring	LWC-AQ1 LWC-AQ2 WAC-AQ3 WAC-AQ5 WAC-AQ6	KEC-AQ1 KCT-AQ1 MGC-AQ1 MEC-AQ1	At each monitoring reach, a visually based habitat assessment (HABSCORE) is undertaken, which evaluates the structure of the surrounding physical habitat that influences the quality of the water resource and the condition of the resident aquatic community (Barbour et al. 1999). Based on this methodology, the aquatic habitat within the study area is described in terms of four category types: Optimal, Suboptimal, Marginal or Poor. Physico-chemical water quality variables are measured at each monitoring reach. These are collected to support the data analysis of aquatic ecological values and are not used as an indicator for potential impacts from underground mining.
Aquatic Macroinvertebrate Monitoring	LWC-AQ1 LWC-AQ2 WAC-AQ3 WAC-AQ5 WAC-AQ6	KEC-AQ1 KCT-AQ1 MGC-AQ1 MEC-AQ1	At each monitoring reach, aquatic macroinvertebrates are surveyed according to the techniques described in the NSW AUSRIVAS Rapid Assessment Method (Turak et al. 2004). This methodology provides for an assessment of the ecological health of each reach through its respective macroinvertebrate community via the application of a data modelling approach. Each year, monitoring is conducted between March 15 and June 15 (autumn survey), and between September 15 and December 15 (spring survey) in order to appropriately apply the AUSRIVAS modelling approach.
Photopoint Monitoring	LWC-AQ1 LWC-AQ2 WAC-AQ3 WAC-AQ5 WAC-AQ6	KEC-AQ1 KCT-AQ1 MGC-AQ1 MEC-AQ1	Permanent photo monitoring points have been established at each aquatic monitoring reach. Photos are taken of the wetted channel at each fixed point in a (1) downstream and an (2) upstream direction. Photos are taken once in spring and once in autumn each year.

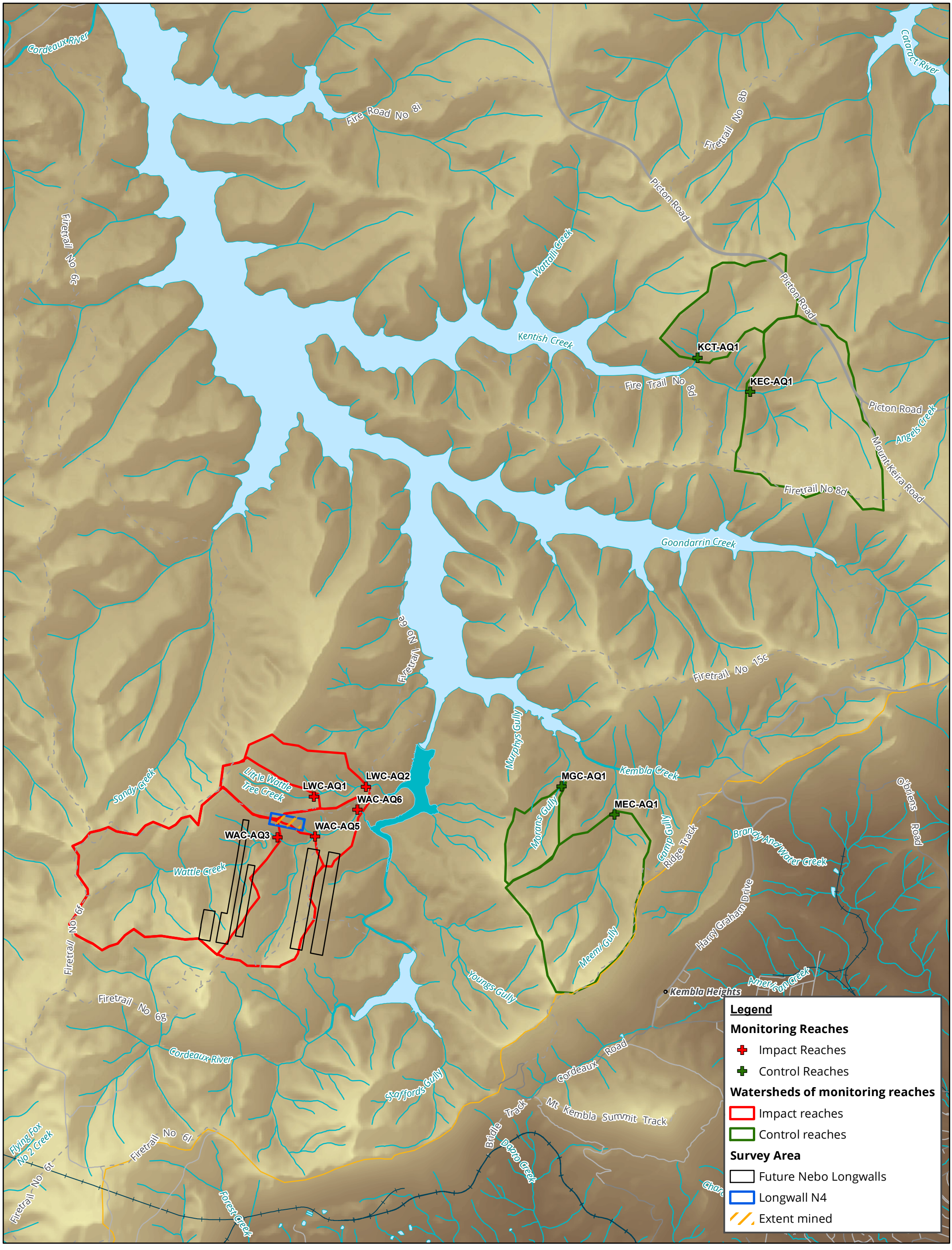

Figure 4: Aquatic ecology monitoring control and impact reaches

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Acknowledgements: Topo (c) NSW Land and Planning Information (2012)

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25100_F4_CatchmentsOverview

0 350 700 1,050 1,400 1,750

Metres
Scale 1:35,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

3 Impact assessment

3.1 Results of monitoring programs

3.1.1 Terrestrial ecology

The Nebo terrestrial ecological monitoring program has been underway since spring 2010. Natural features requiring monitoring included Wattle Tree Creek and Little Wattle Tree Creek. Of the creek impact sites listed in Table 1, only LWTC is positioned to detect potential impacts from N4.

To date, results from terrestrial for LWTC monitoring listed in Table 1 have not detected any subsidence effects on aquatic ecological values in the Wattle Tree Creek and Little Wattle Tree Creek catchments. Detailed results of the terrestrial monitoring program are presented in the annual monitoring reports (Biosis, In Draft b). The field survey data collected indicates that vegetation has not deviated from expected natural trends and baseline sites remain comparable with control sites.

3.1.2 Aquatic ecology

To date, results from aquatic monitoring have not detected any subsidence effects on aquatic ecological values in the Wattle Tree Creek and Little Wattle Tree Creek catchments. Detailed results of the aquatic ecology monitoring program are presented in the annual monitoring reports (Biosis 2017b). The aquatic survey data collected indicates that aquatic ecological values have not deviated from baseline values and remain comparable with the control sites.

3.2 Observed versus predicted impacts

A summary of predicted versus observed impacts as per Niche (2012) is provided in Table 3 below.

Table 3 Observed versus predicted impacts

Value	Predicted Impact (Niche 2012)	Observed Impact	Within Prediction
Rivers (creeks, streams, tributaries)	Low - The maximum predicted subsidence along the creeks is approximately 250mm which occurs above Longwall N5. The predicted subsidence movements and valley related movements along the creeks are predicted to be very low (MSEC 2010). GeoTerra (2010) anticipate that no significant adverse effects will be observed in the creek bed or catchment of Wattle Creek or Little Wattle Tree Creek. Consequently the potential for related impacts on flora and fauna will be low.	No observable changes to frog populations in Wattle Tree Creek or Little Wattle Tree Creek.	Yes
Vegetation	Low – Tree tilt and fall has potential to occur within terrestrial habitats. Low – The maximum subsidence prediction is within rainforest communities including Coachwood Warm Temperate Rainforest and Moist Gully Gum Forest. The potential for impacts on the water table in this locality are expected to be low. As a result the potential for associated consequences for flora and fauna are expected to be low	No observable changes to vegetation composition in Wattle Tree Creek or Little Wattle Tree Creek.	Yes
Upland Swamps	Low – Swamp No.22 and Swamp No.39 are at least 40m from the predicted subsidence footprint and over 400m from the greatest predicted subsidence. The potential for the predicted subsidence to impact on upland swamps is therefore expected to be low.	No upland swamps are located in the vicinity of Longwall N4.	N/A
Rocky habitats	Low - There are no rock faces or rocky areas within the zone of greatest subsidence.	No rocky habitats are located in the vicinity of Longwall N2.	N/A

3.3 TARP assessment

A Trigger Action Response Plan (TARP) was developed for Longwalls N1-N6 as a part of the Biodiversity Management Plan (Niche, 2012). This section assesses whether triggers have been met and whether additional actions are required due to extraction of Longwall N4.

A TARP assessment is provided in Table 4 (riparian vegetation), Table 5 (amphibians), and Table 6 (aquatic ecology).

3.3.1 Longwall N4

Monitoring to date in the Nebo Area has not identified any impacts to flora and fauna, and aquatic ecology sites as a result of subsidence associated with mining of Longwall N4. No other management actions have been triggered under the TARP (Table 4, Table 5 and Table 6).

3.3.2 Cumulative Impacts within the Nebo Mining Domain

Longwall N4 is the second longwall extraction completed within the within the Nebo Area. Longwall N2 commenced in June 2013 and ceased in February 2014.

No cumulative impacts have been recorded following the completions of both longwalls.

4 Conclusions and recommendations

This report assesses the post mining conditions in relation to terrestrial and aquatic ecology within the area potentially impacted by subsidence effects associated with mining of Longwall N4, and compares these observed impacts to impacts predicted to occur.

Observed impacts are within predictions and significant impacts to ecological values have not resulted from the extraction of Longwall N4. No management actions under the TARP have been triggered. No cumulative impacts have resulted from the extraction of both longwalls in the Nebo area.

It is recommended that monitoring of all natural features above Longwall N4 be monitored for one year post-mining. If no impacts are observed during this time monitoring should cease, as per the Biodiversity Management Plan (Niche 2012).

References

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Appendices

Appendix 1 Trigger action response plan

Table 4 Trigger Action Response Plan (TARP) Table, Riparian Vegetation, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6

Feature	Monitoring Program			Impact Assessment		TARPs		
	Prior to Mining	During Mining	Post mining and Future Monitoring	Predicted Impacts	Observed Impacts	Trigger	Response	Action as a result of Longwall N2 and N4
Riparian vegetation 3 Monitoring sites on Wattle Tree Creek 3 Monitoring sites on Little Wattle Tree Creek 6 Reference sites	Species inventory and modified Braun Blanquette cover - Abundance for each species. At least once prior to mining (conducted Autumn and Spring). Baseline monitoring completed to LWTC, ongoing for WTC.	Species inventory and modified Braun Blanquette cover - Abundance for each species. Autumn and spring during entire extraction period. Started for LWTC, not started for WTC.	Species inventory and modified Braun Blanquette cover - Abundance for each species. Autumn and Spring for a minimum of one year post-mining (in consultation with key regulators. Not started.	Unlikely that any threatened flora species would be significantly impacted by subsidence resulting from Longwall mining. Unlikely to be impacts to vegetation communities.	No impact to flora species or vegetation communities observed to date.	**NORMAL** No change as compared to baseline observed **WITHIN PREDICTIONS** Survey results within baseline variability **EXCEEDS PREDICTIONS** Observed deterioration in vegetation health against baseline surveys Significant change/ decline in cover - abundance against baseline surveys. Statistically significant change in species composition against baseline surveys	• Continue monitoring • Report in end of panel report • Continue monitoring • Report in end of panel report • Notification to SCA/DP&E/OEH immediately • Proposal for management within 1 week if required • Completion of management task following approval from agencies • Additional monitoring as required by the relevant government agencies • Report in end of panel report • Reporting in Incident Reports and Annual Reviews	No management action/s required. No change to flora species or vegetation communities was observed when compared to baseline and control sites.

Table 5 Trigger Action Response Plan (TARP) Table, Amphibians, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6

Feature	Monitoring Program			Impact Assessment		TARPs		
	Prior to Mining	During Mining	Post mining and Future Monitoring	Predicted Impacts	Observed Impacts	Trigger	Response	Action as a result of Longwall N2 and N4
Amphibians 3 Monitoring sites on Wattle Tree Creek 3 Monitoring sites on Little Wattle Tree Creek 6 Reference sites	Baseline ecological assessment. Observational monitoring– 50 m nocturnal stream searches and tadpole surveys at three locations 150-200m apart along Wattle Tree Creek and Little Wattle Tree Creek conducted Autumn and Spring. Baseline monitoring completed LWTC, ongoing WTC. Targeted Threatened Amphibian searches each Winter along Wattle Tree Creek and Little Wattle Tree Creek. Completed, no threatened frog habitat found.	Observational monitoring – 50 m nocturnal stream searches and tadpole surveys at three locations 150-200m apart along Wattle Creek and Little Wattle Tree Creek conducted Autumn and Spring during entire extraction period. Completed LWTC, not started WTC. Targeted Threatened Amphibian searches each Winter along Wattle Tree Creek and Little Wattle Tree Creek. Not required.	Observational monitoring– Autumn and Spring for a minimum of one year post-mining (in consultation with key regulators). Not started. Targeted Threatened Amphibian searches in Winter period for a minimum of one year post-mining (in consultation with key regulators). Not required.	Unlikely that any threatened amphibian species would be significantly impacted by subsidence resulting from Longwall mining. Unlikely to be impacts to amphibians or loss of amphibian habitat.	No impact to amphibian populations or habitats observed to date.	**NORMAL** No change as compared to baseline observed **WITHIN PREDICTIONS** Survey results within baseline variability **EXCEEDS PREDICTIONS** Observed physical impacts to habitat. Statistically significant decrease in population numbers and/or species composition against baseline	• Continue monitoring • Report in end of panel report • Continue monitoring • Report in end of panel report • Notification to SCA/D&PE/OEH immediately • Proposal for threatened species management • within 1 week if required • Completion of management task following • approval from agencies • Additional monitoring as required by the • relevant government agencies • Report in end of panel report • Reporting in Incident Reports and Annual Reviews	No management action/s required. No changes in amphibian populations or habitats were observed when compared to baseline and control sites.

Table 6 Trigger Action Response Plan (TARP) Table, Aquatic Ecology, including assessment of actions required by the Subsidence Monitoring Plan for Longwalls N1-N6

Feature	Monitoring Program			Impact Assessment		TARPs		
	Prior to Mining	During Mining	Post mining and Future Monitoring	Predicted Impacts	Observed Impacts	Trigger	Response	Action as a result of Longwall N2 and N4
Aquatic ecology 6 Monitoring sites on Wattle Tree Creek 2 Monitoring sites on Little Wattle Tree Creek 4 Reference sites	Observational monitoring for presence/absence of aquatic habitat during water quality monitoring regime Baseline monitoring completed for Longwall N2 and N4, ongoing as it relates to the Nebo Area. AUSRIVAS macroinvertebrate sampling of reference and impact sites. Descriptions of instream habitat, algal levels, riparian condition, presence/absence of litter, flow level and water quality (Biannually in Autumn and Spring) Baseline monitoring completed for Longwall N2 and N4, ongoing as it relates to the Nebo Area.	Observational monitoring for presence/absence of aquatic habitat during water quality monitoring regime Impact monitoring completed for this stage as it relates to the extraction of Longwall N2 and N4. AUSRIVAS macroinvertebrate sampling of reference and impact sites. Descriptions of instream habitat, algal levels, riparian condition, presence/absence of litter, flow level and water quality (Biannually in Autumn and Spring). Impact monitoring completed for this stage as it relates to the extraction of Longwall N2 and N4	Observational monitoring for presence/absence of aquatic habitat during water quality monitoring regime for a minimum of one year post-mining (in consultation with key regulators). Monitoring ongoing for this stage as it relates to Longwall N2 and N4. AUSRIVAS macroinvertebrate sampling of reference and impact sites. Descriptions of instream habitat, algal levels, riparian condition, presence /absence of litter, flow level and water quality for a minimum of one year post-mining (in consultation with key regulators) (Biannually in Autumn and Spring). Monitoring ongoing for this stage as it relates to Longwall N2 and N4.	Unlikely that any threatened aquatic species would be significantly impacted by subsidence resulting from Longwall mining. Unlikely to be impacts to aquatic ecology or loss of aquatic habitat.	No impact to aquatic ecology or habitats observed to date.	**NORMAL** No change in aquatic biota compared to baseline observed **WITHIN PREDICTIONS** Water flow and quality results within predictions. Survey results within baseline variability **EXCEEDS PREDICTIONS** Water flow and quality results exceed predictions. Statistically significant change observed in survey results against baseline	Continue monitoring. Report in end of panel report. Continue monitoring. Report in end of panel report. Notification to SCA/D&PE/OEH immediately. Proposal for any proposed additional monitoring and management measures within 1 week if required. Completion of agreed management task following approval from regulators. Additional monitoring as required by the relevant government agencies. Report in end of panel report. Reporting in Incident Reports and Annual Review.	No management action/s required. No change in aquatic biota was observed when compared to baseline and control sites. Continue impact monitoring to the completion of one year post mining. Review post mining data and make recommendations on future requirements.