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Tahmoor Coal Pty Ltd

BIODIVERSITY MANAGEMENT PLAN

Tahmoor North Western Domain
Longwalls West 1 and West 2

July 2019

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Document Control

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MINE:	Tahmoor Coal Mine
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1 Introduction

1.1 Background

The Tahmoor Coal Mine (**Tahmoor Mine**) is an underground coal mine located approximately 80 kilometres (**km**) south-west of Sydney between the towns of Tahmoor and Bargo, New South Wales (**NSW**) (refer to **Figure 1-1**). Tahmoor Mine produces up to three million tonnes of Run of Mine (**ROM**) coal per annum from the Bulli Coal Seam. Tahmoor Mine produces a primary hard coking coal product and a secondary higher ash coking coal product that are used predominantly for coke manufacture for steel production. Product coal is transported via rail to Port Kembla and Newcastle for Australian domestic customers and export customers.

The Tahmoor Mine has been operated by Tahmoor Coal Pty Ltd (**Tahmoor Coal**) since Tahmoor Mine commenced in 1979 using bord and pillar mining methods, and via longwall mining methods since 1987. Tahmoor Coal, trading as Tahmoor Coking Coal Operations (**TCCO**), is a subsidiary within the SIMEC Mining Division (**SIMEC**) of the GFG Alliance (**GFG**).

Tahmoor Coal has previously mined 31 longwalls to the north and west of the Tahmoor Mine's current pit top location. Tahmoor Coal is currently mining Longwall 32 in accordance with Development Consents and Subsidence Management Plan Approval.

Tahmoor Coal proposes to extend underground coal mining to the north-west of the Main Southern Railway (referred to as the 'Western Domain') which will include Longwalls West 1 (**LW W1**) to West 4 (**LW W4**) at Picton and Thirlmere. The first two longwalls to be mined are LW W1 and Longwall West 2 (**LW W2**) (collectively referred to as **LW W1-W2**), which will be the focus of this Extraction Plan. The Western Domain is within Mining Lease (**ML**) 1376 and ML 1539, as illustrated in **Figure 1-2** of the Extraction Plan Main Document.

1.2 Purpose

This Biodiversity Management Plan (**BMP**) has been prepared to support an Extraction Plan for the secondary extraction of coal from LW W1-W2. This BMP has been designed to identify the monitoring and management measures for biodiversity within the Extraction Plan Study Area that are required to be implemented to demonstrate that the relevant performance measures are achieved.

1.3 Scope

The Study Area applicable to this BMP consists of a combination of the Predicted 20 millimetre (**mm**) Total Subsidence Contour and the 35^{o} Angle of Draw Line for LW W1-W2 as shown on

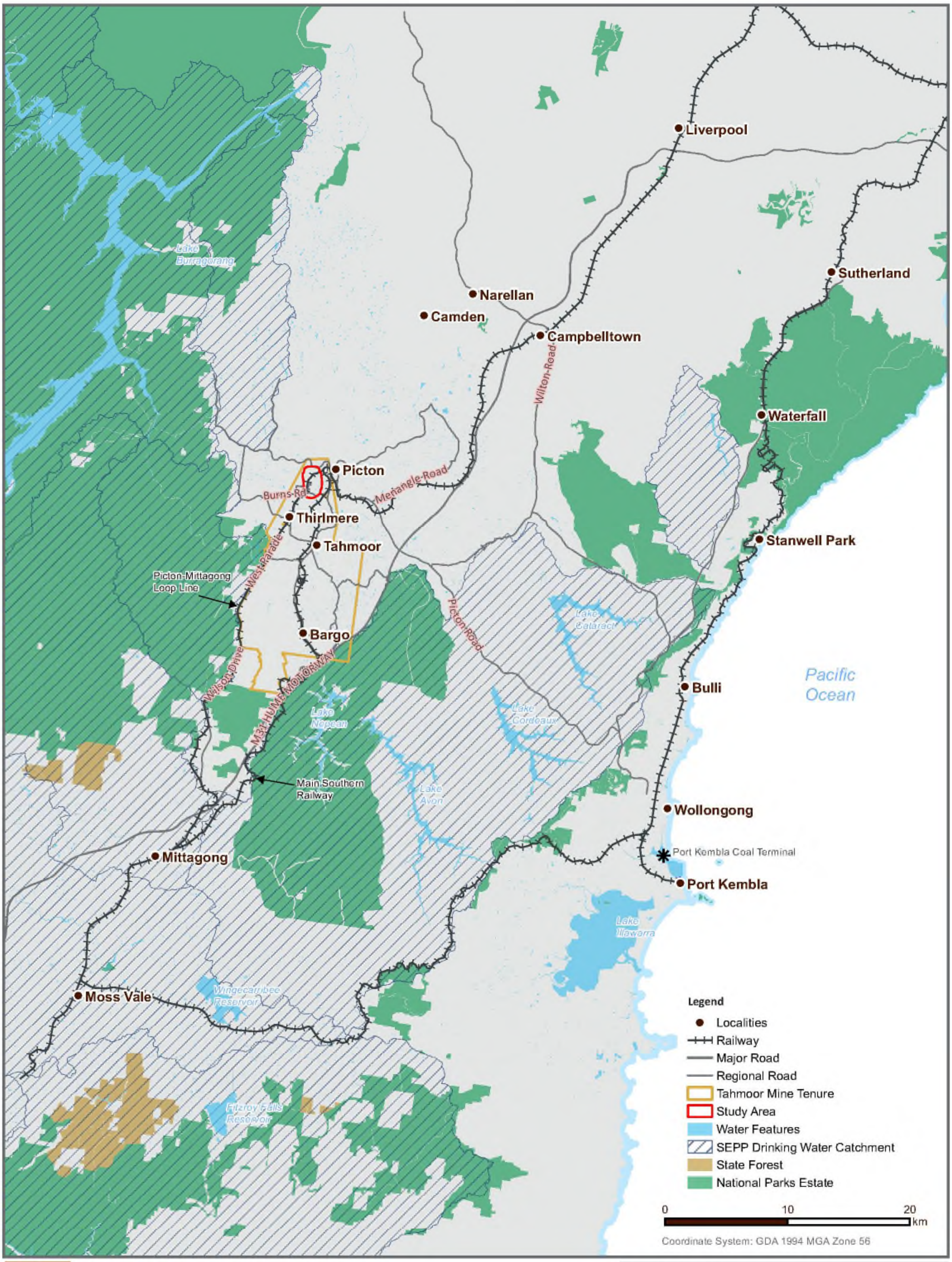
Figure 1-2. Relevant environmental features within a 600 metre (**m**) buffer from extraction that could be susceptible to far-field or valley related movements have also been included for consideration.

This BMP:

- Addresses specific requirements set by DA 67/98 Condition 13H(vii)(d) (refer to **Section 2.1**);
- Addresses related regulatory requirements (refer to **Section 2.2**);
- Addresses the monitoring and management of potential subsidence-related impacts to biodiversity resulting (refer to **Section 5**); and
- Provides a Trigger Action Response Plan (**TARP**) to be implemented to manage and protect known biodiversity values within the Study Area (refer to **Appendix A**).

This BMP has been prepared based on the contents of the following technical reports:

- Aquatic Biodiversity Technical Report (**ABTR**) (Niche, 2019a) (**Appendix B**);
- Western Domain Aquatic Ecology Baseline Report (Niche, 2019b) (appended to **Appendix B**);
- Terrestrial Biodiversity Technical Report (**TBTR**) (Niche, 2019c) (**Appendix C**);
- Western Domain Terrestrial Ecology Baseline Report (Niche, 2019d) (appended to **Appendix C**); and
- Subsidence Predictions and Impact Assessment (MSEC, 2019) (**Volume 1**).



REGIONAL CONTEXT

Tahmoor North Western Domain Longwalls West 1 and West 2 Extraction Plan

FIGURE 1-1

Date: 27/05/2019

Data Sources:
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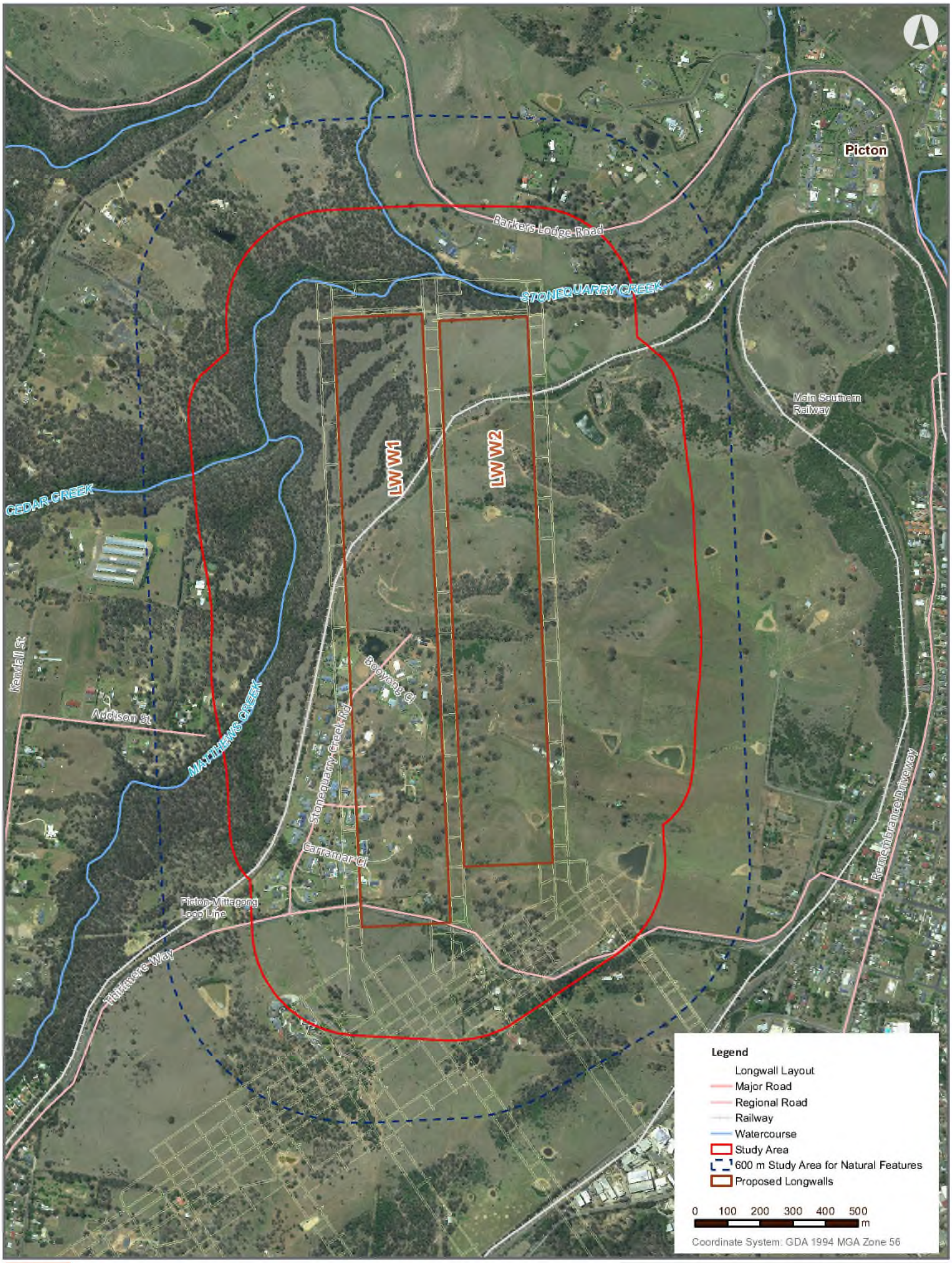

EXTRACTION PLAN STUDY AREA

Tahmoor North Western Domain Longwalls West 1 and West 2 Extraction Plan

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FIGURE 1-2

Date: 4/07/2019

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2 Regulatory Requirements

2.1 Project Approval

2.1.1 Development Consent

Tahmoor Coal's operations are conducted in accordance with applicable Commonwealth and State environmental, planning, mining safety, and natural resource legislation. A register of relevant environmental legislative and regulatory requirements is maintained by Tahmoor Coal in a compliance database.

The proposed LW W1-W2 will be operating in the Tahmoor North mining area under Development Consents DA 57/93 and DA 67/93, as discussed further in **Section 3.2.1** of the Extraction Plan Main Document.

DA 67/98 provides the conditional planning approval framework for mining activities in the Western Domain to be addressed within an Extraction Plan and supporting management plans. Conditions relevant to this BMP from DA 67/98 are detailed in **Table 2-1**.

Table 2-1 Key Conditions from DA 67/98 regarding biodiversity

<table>
<tr><th>Condition</th><th colspan="2">Condition Requirement</th><th>Section Addressed</th></tr>
<tr><td colspan="4">SUBSIDENCE
Performance Measures – Natural and Heritage Features etc.</td></tr>
<tr><td>13A</td><td colspan="2">The Applicant must ensure that extraction of Longwall 33 and subsequent longwalls does not cause any exceedances of the performance measures in Table 1.
Note: The Applicant will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in the various management plans that are required under this consent.</td><td rowspan="4">Section 5, Section 6, Appendix A</td></tr>
<tr><td rowspan="3">Excerpt from Table 1</td><td>Feature</td><td>Performance Measure</td></tr>
<tr><td colspan="2">Biodiversity</td></tr>
<tr><td>Threatened species, threatened populations, or endangered ecological communities</td><td>• Negligible environmental consequences.</td></tr>
<tr><td>13B</td><td colspan="2">Measurement and monitoring of compliance with performance measures and performance indicators in this consent is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans and monitoring programs. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.</td><td>Section 5, Section 6, Appendix A</td></tr>
</table>

Condition	Condition Requirement	Section Addressed
Additional Offsets		
13C	If the Applicant exceeds the performance measures in Table 1 and the Secretary determines that: • it is not reasonable or feasible to remediate the subsidence impact or environmental consequence; or remediation measures implemented by the Applicant have failed to satisfactorily remediate the subsidence impact or environmental consequence, • then the Applicant must provide a suitable offset to compensate for the subsidence impact or environmental consequence, to the satisfaction of the Secretary.	Noted. Performance measures in Table 1 of DA 67/98 are not anticipated to be exceeded.
13D	The offset must give priority to like-for-like physical environmental offsets, but may also consider payment into any NSW Offset Fund established by OEH, or funding or implementation of supplementary measures such as: • actions outlined in threatened species recovery programs; • actions that contribute to threat abatement programs; • biodiversity research and survey programs; and/or • rehabilitating degraded habitat. *Note: Any offset required under this condition must be proportionate with the significance of the impact or environmental consequence*	Noted. Performance measures in Table 1 of DA 67/98 are not anticipated to be exceeded.
Extraction Plan		
13H(vi)	describe in detail the performance indicators to be implemented to ensure compliance with the performance measures in Table 1 and Table 2, and manage or remediate any impacts and/or environmental consequences;	Section 5.1, Section 5.2, and Section 6
13H(vii)(d)	Biodiversity Management Plan which has been prepared in consultation with OEH, which establishes a baseline data for the existing habitat on the site, including water table depth, vegetation condition, stream morphology and threatened species habitat, and provides for the management of potential impacts and environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats, EECs and groundwater dependent ecosystems	Consultation detailed in Section 2.3 Monitoring detailed in Section 5 Management Detailed in Section 6 and Appendix A
13H(vii)(h)	Trigger Action Response Plan/s addressing all features in Table 1 and Table 2, which contain:	Section 6.3, Section 6.5, Appendix A
	• appropriate triggers to warn of increased risk of exceedance of any performance measure; and	
	• specific actions to respond to high risk of exceedance of any performance measure to ensure that the measure is not exceeded;	
	• an assessment of remediation measures that may be required if exceedances occur and the capacity to implement the measures; and	
	• adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 1 or Table 2, or where any such exceedance appears likely; an	

Condition	Condition Requirement	Section Addressed
13H(vii)(i)	Contingency Plan that expressly provides for:	Section 5.3, Section 6.4, Section 6.5, Appendix A
	• adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Table 1 and Table 2, or where any such exceedance appears likely; and	
	• an assessment of remediation measures that may be required if exceedances occur and the capacity to implement those measures; and	
	• includes a program to collect sufficient baseline data for future Extraction Plans.	

2.1.2 Extraction Plan Guideline

This BMP has been prepared in accordance with the *Guidelines for the Preparation of Extraction Plans V5* (Department of Planning and Environment (DPE), 2015), as illustrated in **Table 2-2**.

Table 2-2 Extraction Plan Guideline Requirements for Key Component Plans

Extraction Plan Guideline Content Requirements for Key Component Plans	Section(s) Addressed
An overview of all landscape features, heritage sites, environmental values, built features or other values to be managed under the component plan.	Section 3
Setting out all performance measures included in the development consent relevant to the features or values to be managed under the component plan.	Section 2.1.1, Section 5.1
Setting out clear objectives to ensure the delivery of the performance measures and all other relevant statutory requirements (including relevant safety legislation).	Section 2, Section 5.1, Section 6
Proposing performance indicators to establish compliance with these performance measures and statutory requirements.	Section 5.1
Describe the landscape features, heritage sites and environmental values to be managed under the component plan, and their significance.	Section 3
Describe all currently-predicted subsidence impacts and environmental consequences relevant to the features, sites and values to be managed under the component plan.	Section 4
Describe all measures planned to remediate these impacts and/or consequences, including any measures proposed to ensure that impacts and/or consequences comply with performance measures and/or the Applicant's commitments.	Section 6, Appendix A
Describe the existing baseline monitoring network and the current baseline monitoring results, including pre-subsidence photographic surveys of keylandscape features and key heritage sites which may be subject to significant subsidence impacts (such as significant watercourses, swamps and Aboriginalheritage sites).	Section 3, Section 5.2
Fully describing the proposed monitoring of subsidence impacts and environmental consequences.	Section 5.2
Describe the proposed monitoring of the success of remediation measures following implementation.	Section 6.4, Appendix A
Describe adaptive management proposed to avoid repetition of unpredicted subsidence impacts and/or environmental consequences.	Section 6.5
Describe contingency plans proposed to prevent, mitigate or remediate subsidence impacts and/or environmental consequences which substantially exceed predictions or which exceed performance measures.	Section 6.4, Appendix A
Listing responsibilities for implementation of the plan.	Section 7.3

Extraction Plan Guideline Content Requirements for Key Component Plans	Section(s) Addressed
An attached Trigger, Action, Response Plan (effectively a tabular summary of most of the above).	Appendix A

2.2 Relevant Legislation

The relevant Acts and regulations protecting and managing biodiversity in New South Wales are detailed in the sections below.

2.2.1 Biodiversity Conservation Act 2016

The NSW *Biodiversity Conservation Act 2016* (**BC Act**) provides protection for threatened species native to NSW (excluding fish and marine vegetation). Species, populations and ecological communities listed under Schedule 1 (Endangered) and Schedule 2 (Vulnerable) are considered to be threatened in NSW.

Protection is provided by integrating the conservation of threatened species, endangered populations and Endangered Ecological Communities / Critically Endangered Ecological Communities (**EEC/CEECs**) into development control processes under the NSW *Environmental Planning and Assessment Act 1979* (**EP&A Act**).

No significant impacts to threatened biodiversity listed under the BC Act are likely as a result of the extraction of LW W1-W2.

2.2.2 Fisheries Management Act 1994

The objectives of the *Fisheries Management Act 1994* are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. In particular, the objectives of this Act include to:

- Conserve fish stocks and key fish habitats;
- Conserve threatened species, populations and ecological communities of fish and marine vegetation; and
- Promote ecologically sustainable development, including the conservation of biological diversity.

Protection is provided by integrating the conservation of threatened species, endangered populations and EEC/CEECs into development control processes under the EP&A Act. There is a very low likelihood of any threatened species, populations or ecological communities listed under the *Fisheries Management Act 1994* to be impacted by the approved disturbance.

2.2.3 Environment Protection and Biodiversity Conservation Act 1999

Under the EPBC Act, approval from the Commonwealth Minister for Department of Environment is required for any action that may have a significant impact on Matters of National Environmental Significance (**MNES**). These matters are:

- Listed threatened species and ecological communities;
- Migratory species protected under international agreements;
- Ramsar wetlands of international importance;
- The Commonwealth marine environment;

- World Heritage properties;
- National Heritage place;
- Great Barrier Reef Marine Park;
- Nuclear actions; and
- A water resource, in relation to coal seam gas development and large coal mining development.

No significant impacts to threatened biodiversity listed under the EPBC Act are likely as a result of the extraction of LW W1-W2.

2.3 Consultation

NSW Office of Environment and Heritage (**OEH**) was consulted during the preparation of this BMP. A summary of consultation received is provided in **Section 2.1.2** of the Extraction Plan Main Document, and a copy of the incoming correspondence is also provided in **Appendix C** of the Extraction Plan Main Document.

3 Existing Environment

3.1 Aquatic Ecology

The following subsections have been sourced from the ABTR (**Appendix B**) and the Western Domain Aquatic Ecology Baseline Report (appended to **Appendix B**). These reports should be referred to for further detail regarding baseline conditions of aquatic biodiversity.

3.1.1 Baseline Monitoring Data Sources

The existing environment has been characterised using baseline studies and ongoing aquatic monitoring in the Study Area. These include:

- Tahmoor North Longwalls 31 to 37 Aquatic Ecology Assessment (Niche, 2014a):
  - Riparian Channel and Environment Inventory assessment to rank the relative health of stream condition;
  - Australian River Assessment System (**AUSRIVAS**) stream health assessment (including aquatic habitat, macrophytes, in situ water quality and macroinvertebrates);
  - Fish survey;
  - Threatened species and key fish habitat assessment;
- Biannual aquatic ecological monitoring for Spring 2017, Autumn 2018, Spring 2018 and Autumn 2019 (Niche, 2019b):
  - Riparian Channel and Environment Inventory assessment to rank the relative health of stream condition;
  - AUSRIVAS stream health monitoring (including aquatic habitat, macrophytes, in situ water quality and macroinvertebrates);
  - Quantitative macroinvertebrate (Before After Control Impact (**BACI**)) monitoring;
  - Fish survey;
- Tahmoor Coal Pty Ltd - Tahmoor Colliery Longwall Panels 31 to 37 Streams, Dams & Groundwater Assessment, Tahmoor, NSW (GeoTerra, 2014); and
- Extraction Plan LW W1 – W2 - Surface Water Technical Report (HEC, 2019).

3.1.2 Watercourses and Stream Morphology

The Study Area is located in the Stonequarry Creek catchment with the natural waterway features comprising Matthews Creek, Cedar Creek and Stonequarry Creek (refer **Figure 1-2**). Baseline pool water level and surface water quality data has been collected within and surrounding the Study Area by HEC (2019), which has been incorporated throughout this section.

Matthews Creek and Cedar Creek rise in low hills to the west of the Study Area, with their junction approximately 200 m west of LW W1. Stonequarry Creek also rises to the west and flows east along the northern boundary of the Study Area, joining Cedar Creek approximately 130 m north of LW W2, before flowing east and south through the town of Picton. Redbank Creek flows into Stonequarry Creek towards the south-east of the Study Area. Stonequarry Creek continues to flow south-east, joining the Nepean River near Maldon (HEC, 2019).

Matthews Creek

The headwaters of Matthews Creek lie within the residential area of Thirlmere, with residential development significantly affecting the vegetation and weed growth along the upper reaches of the creek. The catchment comprises mainly rural properties. The creek flows to the north-east on the northern side of Thirlmere (**Figure 3-1**). The creek then flows to the north, downstream of Thirlmere, through a rural area with sparse residential development, along with poultry farms, commercial vegetable gardens and a shale quarry. The riparian zone of the creek contains thick native vegetation in this region. The creek in the vicinity of Thirlmere is generally in a poor state, with a high content of weeds and rubbish dumped or washed into it. Downstream of the residential area the creek significantly improves to a more natural state, down to the junction with Cedar Creek. To date, the creek has not been mined beneath, and the headwaters of the creek are located outside of the Study Areas of the previous and current longwalls.

Within the Study Area, Matthews Creek is a 4th order stream system that drains to the north into Cedar Creek, which subsequently flows to Stonequarry Creek, then the Nepean River. The creek flows north, adjacent to the proposed LW W1 in the western portion of the Study Area. Matthews Creek does not overlie any longwalls, however it is within the 20 mm subsidence area for approximately 850 m of its reach.

Within the Study Area, Matthews Creek is relatively incised in Hawkesbury Sandstone, with a steep V-shaped valley and isolated vertical scarps predominating adjacent. Just upstream and at the junction with Cedar Creek, the valley becomes more incised and steeper with more predominant vertical scarps in the basal exposed sandstone of the valley. Overhangs of undercut sandstone are also prevalent in this section. Within the Study Area, Matthews Creek falls approximately 40 m in height over a total length of approximately 1,600 m, with an inferred average gradient of 25 mm/m (MSEC, 2014). The stream bed and banks of Matthews Creek are well vegetated and do not show significant erosion or bank instability, principally as it is developed on, or just above, exposed Hawkesbury Sandstone basement.

Water level baseline data for Matthew Creek has been detailed in HEC (2019), which described Matthews Creek as exhibiting ‘flashy’ responses to rainfall events, and indicates that pools in Matthews Creek within the Study Area experience natural periods of no flow.

Eastern tributary gullies of Matthews Creek flow above proposed LW W1 and LW W2 (HEC, 2019). The minor eastern tributaries of Matthews Creek within the Study Area are ephemeral and likely only flow during periods of extended or high rainfall. Surface water runoff from these tributaries has been partially diverted by urban drainage associated with “Stonequarry Estate” housing estate and flows through stormwater detention basins/dams and culverts under the rail line, with runoff from the tributaries likely to contribute to flow in Matthews Creek during periods of extended or significant rainfall only (HEC, 2019).

Cedar Creek

The catchment area of Cedar Creek contains rural properties including a number of poultry farms, while the upper reaches are timbered and the head of the catchment lies within the Nattai National Park (HEC, 2019). The riparian zone of the creek contains thick native vegetation. To date, the creek has not been mined beneath, and the headwaters of the creek are located outside of the Study Areas of the previous and current longwalls. The creek does not directly overlie the proposed longwalls however it is located approximately 50 m north of LW W1 for approximately 300 m upstream of its confluence with Stonequarry Creek (**Figure 3-1**).

Cedar Creek lies within the Study Area from the Stonequarry Creek confluence to approximately 500 m upstream of its confluence with Matthews Creek, adjacent to the northern boundary of the Study Area (**Figure 3-1**). Within the Study Area, Cedar Creek is a 5th order stream system that drains to the west then north to Stonequarry Creek, which subsequently flows to the Nepean River. Cedar Creek joins with Stonequarry Creek adjacent to the northern boundary of LW W2 and has an estimated catchment area of 27 square km.

Within the Study Area, Cedar Creek is distinctly incised in Hawkesbury Sandstone, and has a steep valley with prominent, although discontinuous, vertical sandstone ledges in the lower elevations of the valley. Overhangs of undercut sandstone are prevalent in the mid study reach of the creek. Near the junction with Matthews Creek, it has a wider base, although remains deeply incised in a steep sided valley with an exposed sandstone base. Further downstream the valley floor is wider, although there are less undercut sandstone overhangs. In this reach, and downstream to the junction with Stonequarry Creek, the creek remains in a steep sided valley, which opens up with an elongated permanent pool present at the junction. The creek within the Study Area is in a natural state to the junction with Stonequarry Creek. The creek's bed and banks are well vegetated and do not show erosion or bank instability, principally as it is developed on, or just above, exposed Hawkesbury Sandstone basement.

Groundwater seepage has been observed to occur at the junction of Cedar Creek and Matthews Creek based on high iron hydroxide precipitation within this reach (Niche, 2014a).

A minor tributary gully of Cedar Creek flows from east to west over the northern portion of LW W1 and LW W2. The minor tributary of Cedar Creek within the Study Area is ephemeral and likely only flows during periods of extended or high rainfall. Surface water runoff from the headwater of this tributary is predominately captured by a farm dam with runoff from the tributary likely to contribute to flow in Cedar Creek during periods of extended or significant rainfall only. Flow in the tributary passes through a culvert under the Picton Mittagong Loop Line before flowing to Cedar Creek (HEC, 2019).

Water level baseline data for Cedar Creek has been detailed in HEC (2019). As described by HEC (2019), Cedar Creek monitoring sites were fairly consistent during the monitoring period with subdued small peaks in water level recorded during rainfall periods. Sharp increases in water level were recorded at the most upstream monitoring sites following rainfall events followed by steep recessions, however, the water level was below the cease to flow level for the majority of the monitoring period prior to rising above the cease to flow level following rainfall in late January 2019 and again in March (HEC, 2019).

Stonequarry Creek

The catchment area of Stonequarry Creek upstream of the Study Area comprises mainly rural properties and farmland with localised housing development (HEC, 2019). The headwaters of Stonequarry Creek lie to the north and west of Cedar Creek. Stonequarry Creek flows in a southerly direction immediately upstream of its junction with Cedar Creek, then to the east downstream of the junction through a rural area with sparse residential development, along with poultry farms, commercial vegetable gardens and a shale quarry. The riparian zone of the creek contains thick native vegetation and high weed growth in the Study Area. To date, the creek has not been mined beneath, and the headwaters are located outside of the Study Areas of the previous and current longwalls.

Within the Study Area, Stonequarry Creek is a 5th order stream system, and is the northern most creek which flows to the Nepean River. Stonequarry Creek flows along the northern boundary of the Study Area and has an estimated catchment area of 44 km^2 to the downstream boundary of the Study Area. Cedar Creek joins Stonequarry Creek near the northern edge of LW W1-W2 (**Figure 3-1**). Stonequarry Creek subsequently flows to the east, downstream of LW W2.

The creek bed has a low gradient in the Study Area, with a predominance of rock bar, boulder and rock shelf constrained pools in its upper reaches, which are predominantly overgrown with weeds. An extended rock shelf is present approximately 175 m (and further) downstream of LW W2, which is maintaining the long upstream pool water level. The bed and banks of the creek are well vegetated and do not show significant erosion or bank instability, principally as it is developed on, or just above, exposed Hawkesbury Sandstone basement.

Stonequarry Creek is not particularly incised, although it is predominantly based on Hawkesbury Sandstone in the upstream section of the Study Area, with low valley sides. Downstream of the junction with Cedar Creek it has a wider channel and contains a long permanent pool.

A minor tributary of Stonequarry Creek flows from south to north adjacent to the proposed LW W2. Stonequarry Creek then flows east outside the boundary of the Study Area, through the town of Picton, joining the Nepean River near Maldon. The minor tributary of Stonequarry Creek within the Study Area is ephemeral and likely only flows during periods of extended or high rainfall. Surface water runoff from the headwater of the tributary is predominately captured by a farm dam with runoff from the tributaries likely to contribute to flow in Stonequarry Creek during periods of extended or significant rainfall only. Flow in the tributary passes through a culvert under the Picton-Mittagong Loop Line before flowing to Stonequarry Creek (HEC, 2019).

Baseline data by HEC (2019) has indicated that water level at Stonequarry Creek remained above the cease to flow (**CTF**) level for the duration of the monitoring period, while the water level at downstream sites regularly fell below the CTF level, exhibiting 'flashy' responses to rainfall events followed by steeper recessions (HEC, 2019).

3.1.3 Aquatic Biodiversity

Aquatic baseline monitoring includes an initial stream health assessment conducted in 2015 and monitoring primarily based on AUSRIVAS and quantitative macroinvertebrate sampling biannually since Spring 2017 (Niche, 2019b). The baseline monitoring program was conducted in November 2017, April 2018, November 2018 and May 2019 and employed the following survey methods:

- Aquatic habitat assessment comprising:
  - The Australian River Assessment System (AUSRIVAS);
  - Riparian Channel and Environment (**RCE**) Inventory;
- Macroinvertebrate survey comprising:
  - AUSRIVAS macroinvertebrate sampling;
  - A quantitative benthic macroinvertebrate monitoring program (to be updated when samples have been identified and analysed);
- Water quality sampling; and
- Fish sampling.

The baseline monitoring is primarily focused on macroinvertebrate monitoring regimes including AUSRIVAS and quantitative BACI design. In AUSRIVAS macroinvertebrate samples are compared to modelled reference sites and is a rapid assessment based on presence/absence of invertebrates. This provides of before /after impact monitoring of the sites through time.

The quantitative macroinvertebrate program compares potential impacts sites with upstream control sites and contains community assemblage data, which can be used to determine quantitative changes in fauna abundance, richness and structure that may be otherwise be missed by a rapid assessment approach. This approach takes into account the natural variability of the stream through the comparison to upstream control sites.

Collected habitat and water quality data is used to aid the interpretation of macroinvertebrate monitoring; to determine the likely drivers behind any changes in stream health indicators.

The monitoring locations for the current monitoring program are shown in **Figure 3-1**, summarised below in **Table 3-1**. The major results and conclusions from the baseline aquatic monitoring are provided in **Table 3-2**, and more detailed analysis of baseline results are provided in the report by Niche (2019a).

Table 3-1 Monitoring Site Summary

Site number	Site code	Watercourse	Sampling method
Potential impact sites – baseline (not yet impacted)			
Site 4	SQC4	Stonequarry Creek	• Aquatic habitat assessment; • AUSRIVAS and Quantitative macroinvertebrate sampling; • Water quality sampling; and • Fish sampling.
Site 5	CC5	Cedar Creek	
Site 6	CC6	Cedar Creek	
Site 7	MC7	Matthews Creek	
Site 8	MC8	Matthews Creek	
Site 15	SQC15	Stonequarry Creek	• Quantitative macroinvertebrate sampling; • Water quality sampling; and • Fish sampling.
Control sites			
Site 9	CC9	Cedar creek	• Quantitative macroinvertebrate sampling; • Water quality sampling; and • Fish sampling.
Site 10	CC10	Cedar Creek	
Site 11	CC11	Cedar Creek	
Site 12	CC12	Cedar creek	
Site 13	SQC13	Stonequarry Creek	
Site 14	SQC14	Stonequarry creek	
Site 16	CC 16	Cedar Creek	

Table 3-2 Summary of results and conclusions of baseline studies

Indicator	Parameter	Results	Conclusion
Stream condition/ aquatic habitat	Stream condition	Matthews Creek, Stonequarry Creek and Cedar Creek were found to be in moderate to good stream/riparian condition with the best habitat located within the gorge along Matthews/Cedar Creek above Stonequarry Creek.	Stream are generally in moderate to good condition however low flows places natural stress on the aquatic environment and the availability and quality of aquatic habitat. Iron floc occurring in CC6 is natural and may indicate groundwater influencing benthic habitat at the location.
	Aquatic habitat	Habitat availability varied among seasons, particularly at MC8, which was dry on two occasions and could not be sampled. Macrophyte diversity was low with in the gorge and greatest downstream (CC5 and SC4). Iron staining was observed at CC6.	
Water quality	Electrical conductivity	The water quality results showed high salinity (approximately 1000 µS/cm) within and upstream the Study Area.	This indicated that electrical conductivity is naturally elevated above ANZECC guidelines in and upstream of the Study Area and resident fauna are likely to be adapted to these relatively high concentrations.
	Dissolved oxygen	Low dissolved oxygen was characteristic of all sites	Low dissolved oxygen is considered normal for stream pools exhibiting low- to no-flow conditions.
	pH	The pH was generally within ANZECC guidelines in Spring 2017 and Autumn 2018 however appear to decrease below ANZECC guidelines in Spring 2018 and Autumn 2019.	This reduction may be related to low rainfall, less surface water flow and increase in groundwater water influence.
	Alkalinity	Alkalinity was generally low in all streams	Indicating a low buffering capacity against changes in pH.
Macroinvertebrates	AUSRIVAS	Most sites on all sampling occasions were different to modelled reference sites scoring in Band B and Band C. Only two occasions of scores in Band A (close to reference condition) in MC7 and SQC4.	Low stream health scores and indices that were observed in the baseline study can be considered natural characteristics of drying intermittent/low flow streams.
	SIGNAL	Most sites had low signal score (<4).	
	EPT	EPT scores were generally low with Cedar Creek CC5 having the highest score. Most common pollution sensitive EPT taxa included Calamoceridae, Leptoceridae and Leptophlebiidae.	
Fish	Fish counts	Few fish were observed. Most common in the Study Area and upstream sites was introduced *Gambusia Holbrooki*. One native fish was identified with in the study area *Gobiomorphus coxii. Galaxias olidus* was found in Cedar Creek upstream of the Study Area.	Fish are unlikely to be a good indicator of environmental impact.

3.1.4 Threatened species

As discussed in the ABTR (Niche, 2019a), there are no aquatic threatened species considered likely to occur in the Study Area, and therefore aquatic threatened species are unlikely to be impacted by longwall mining as part of the extraction of LW W1-W2. No threatened species have been identified as part of the baseline monitoring.

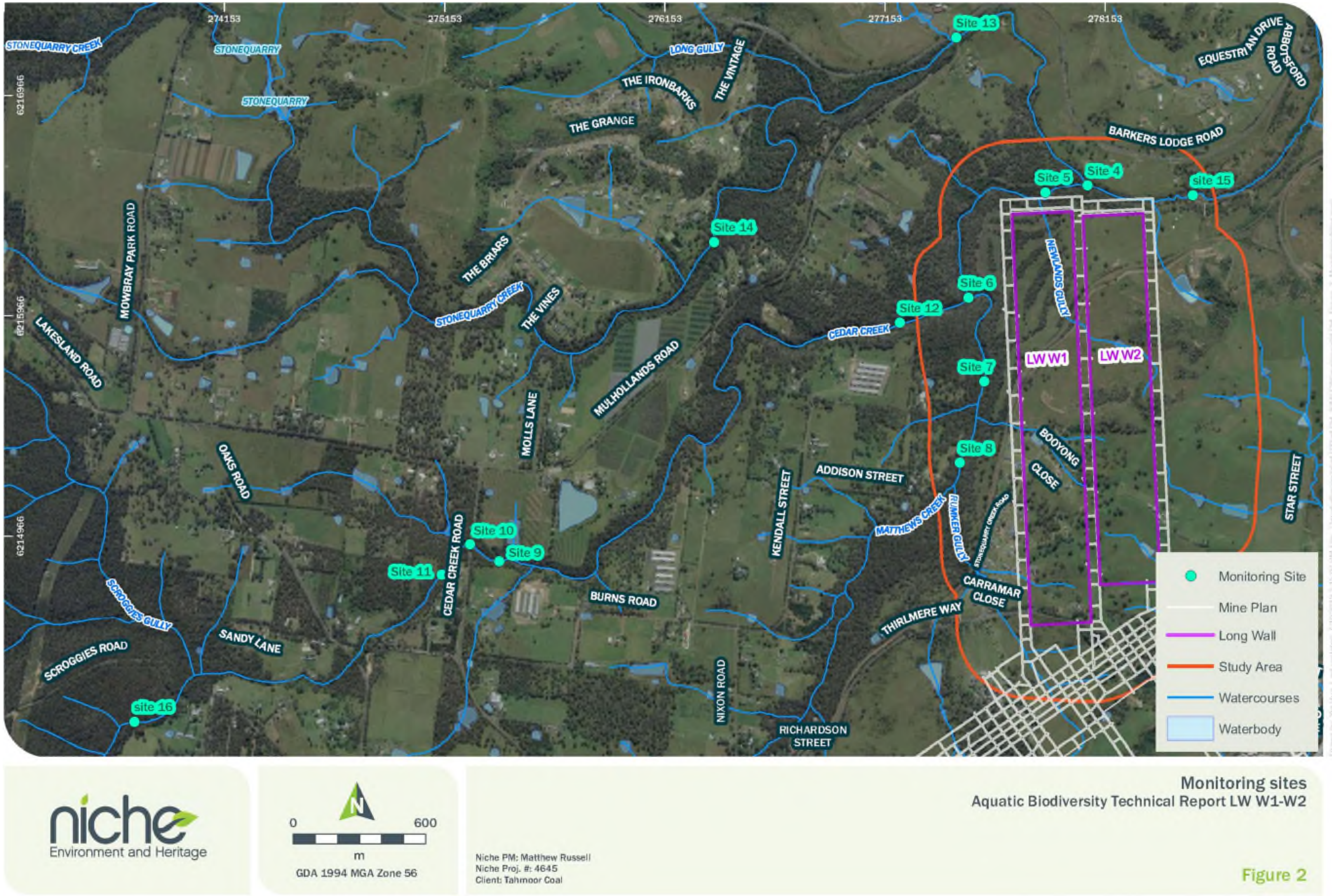

Figure 3-1 Aquatic Ecology Monitoring Sites (Niche, 2019a)

3.2 Terrestrial Ecology

The following subsections have been sourced from the TBTR (**Appendix C**) and the Western Domain Terrestrial Ecology Baseline Report (appended to **Appendix C**). These reports should be referred to for further detail regarding baseline conditions of terrestrial biodiversity.

3.2.1 Previous Assessments and Baseline Monitoring

The existing environment is characterised by baseline studies and on-going terrestrial ecology monitoring (amphibians and riparian monitoring) in the Study Area. Relevant studies include the following:

- Tahmoor North Longwalls 31 to 37 Terrestrial Ecology Assessment (Niche, 2014b):
  - Validated vegetation mapping;
  - Threatened flora surveys;
  - Habitat survey for threatened fauna;
  - Amphibian survey;
  - Impact assessment under both State and Commonwealth legislation;
- Biannual terrestrial ecological monitoring for Spring 2017, Autumn 2018, Spring 2018 and Autumn 2019 (Niche, 2019d):
  - Riparian vegetation monitoring;
  - Collection of flora plots/transects; and
  - Amphibian transects.

3.2.2 Vegetation Mapping

Vegetation in the Study Area has been mapped as part of NPWS (2002) Cumberland Plain Vegetation Mapping Project and Tozer (2006) Native vegetation of southeast NSW, which was confirmed during the field survey completed by Niche (2014b).

Six vegetation communities have been mapped within the Study Area by Tozer et al (2006) and Niche (Niche, 2019b), which included the following:

- Cumberland Shale Sandstone Transition Forest;
- Cumberland Shale Hills Woodland;
- Cumberland River Flat Forest;
- Coastal Sandstone Ridgetop Woodland;
- Hinterland Sandstone Gully Forest; and
- Sydney Hinterland Transition Woodland.

3.2.3 Riparian Vegetation Baseline Data

The vegetation along the riparian corridors of the Study Area were surveyed (where possible) as part of Niche (2014b) survey, and portions surveyed as part of the riparian monitoring program (Niche, 2019d).

The riparian monitoring program has been designed as a BACI study, such that a sufficient amount of data is collected over time in order to be able to compare any changes towards ecology indicators as a result of subsidence. Riparian vegetation monitoring sites have been set up along Matthews Creek, Cedar Creek, and Stonequarry Creek which include three impact sites (sites 3, 4 and 5) and five control sites (sites 6, 7, 8, 9, and 10) as illustrated in **Figure 3-2**.

Vegetation along the upper banks of Stonequarry Creek has been mapped as Cumberland Shale Sandstone Transition Forest (Plant Community Type (PCT) 1395) with a small section of Cumberland River-flat Forest (PCT835) occurring to the north of the longwalls. The vegetation along the banks of Matthews Creek and Cedar Creek has been mapped as Hinterland Sandstone Gully Forest (PCT1181). The condition of the vegetation communities varied depending on grazing, historic clearing and invasion by introduced species. Cumberland River-flat Forest (PCT835) contained a greater number of introduced species. The headwaters of Matthews Creek lie within the residential area of Thirlmere, with the condition of the creek significantly degraded by residential development.

A summary of the findings from analysis of the riparian monitoring baseline data is provided below, with further information provided in **Appendix C**.

Species Diversity and Richness

A total of 129 flora species were detected during the 2018 Spring monitoring session, of which 33 were exotic and 96 were native species. A total of 157 flora species were detected during the 2019 Autumn monitoring session, of which 39 were exotic and 118 were native species.

These numbers were lower for both monitoring events than the previous year of data collection with 154 species detected during the 2017 Spring (38 exotic, 116 native) and 164 species detected during the 2018 Autumn surveys, (44 exotic, 120 native). This is likely due to dry conditions experienced recently throughout the region.

Species richness across sites ranged from 22 to 63 species in Spring 2018 and 22 to 56 species in Autumn 2019. This is comparable with results from the first year of monitoring, where species richness ranged from 20 to 57 species in Spring 2017 and 18 to 59 species in Autumn 2018. The most frequently recorded species included: *Microlaena stipoides*, *Lomandra longifolia, Solanum prinophyllum, Adiantum aethiopicum, Persicaria decipiens, Oplismenus aemulus, Entolasia marginata, Ehrharta erecta, Morinda jasminoides, Bursaria spinosa, Oxalis perennans, Notelaea longifolia, Entolasia strict* and *Backhousia myrtifolia.*

During the Spring 2018 monitoring session, the impact sites had an average of 39 species which was slightly lower than the average of 44.4 species recorded in the control sites. This was consistent with Spring 2017, with an average of 30.7 species present within impact sites and 42.4 in the control.

The Autumn 2019 monitoring impact sites recorded an average of 40.33 species which was also slightly lower than the average of 46.4 species recorded in control sites. Similarly, this is consistent with the Autumn 2018 impact sites recording an average of 36.3 species, which was lower than the recorded average of 44.8 species recorded in the control sites.

Control sites 7, 8 and 10 were found to have the highest species richness throughout the second year of data collection, averaging 51.5, 58 and 57 respectively. These results are consistent with the previous years, with the exception of site 8, which has increased in richness comparatively to other sites. Species richness was lower at control site 6, which is consistent with the results of the previous year. Impact sites for all monitoring events recorded lower species diversity then control sites.

Composition, Structure and Function

The key indicators collected in the BAM methodology were utilised to assess condition, structure and function of vegetation/habitat features within each of the quadrats. Two years of baseline monitoring has allowed for an understanding of the natural variation experienced in these ecosystems. Given their riparian nature, a higher degree of variation in diversity, abundance and structure is expected. Other variation, such as vegetation condition, can be explained by difference in personal judgement.

Over the two years, differences in some of the key attributes between the two seasons were observed. This is predicted given changes in foliage cover between seasons, vegetation growth, branch loss and natural die back of species such as annuals. The importance of this tool is it provides a representation of the sites in term of habitat condition. Two years of declining scores of the key attributes within the creeks may indicate factors impeding the health of the riparian ecosystem. Over the previous two years, no decline has been confirmed, however, ambiguity in the methodology relating to ground log amounts may explain a large amount of the variation in these indicators over both years and seasons. Clarification on these methods within field survey teams will allow for more robust monitoring going forward.

Floristic Variability Between Sites

The topographic and geological setting for the sites is across a range of types. As a result there is considerable "natural" variability between sites.

Only two site pairs came in with a Bray Curtis similarity score of better than 50% being plots 4 and 5 (both impact sites) at 65% and plots 5 and 10 at 52%. The site with the lowest similarity scores was plot 9 which had a similarity score of 7% with plot 7 and less for every other pairing. As a result, plot 9 stands out on its own on the multi-dimensional scaling ordination. There is a loose collection of the three impact sites and control site 10 which are all within 40% similarity.

The mean cover between sites fluctuated by up to 37 percent between monitoring events. In general, cover between the first round of seasonal monitoring and the second round has decreased. Mean cover for both the impact and control sites in Spring were higher than that of the Autumn monitoring events, with the exception of control sites in Autumn 2019, which were higher. Control sites for all monitoring events showed higher mean vegetation cover compared with the impact sites.

In regards to cover, no pattern can be established between Spring and Autumn 2017-2019 monitoring events. Three of the four impact sites cover scores (site 3, 4 and 6) decreased in Autumn 2019, while all of the Autumn 2019 control sites cover scores increased.

Exotic species, which typically made up only a small percentage of the sites cover, remained relatively constant throughout all monitoring events. Native cover fluctuated much more, which is likely just the result of the overall higher levels of native cover at all sites.

Sites which occurred in a more protected environment, such are deep gullies or cannons, tended to have less fluctuation in species richness and cover. This could reflect the sheltered environment which may present a buffer to the seasonal conditions. However, these sites also tend to have poorer soils and are less suited to the establishment and persistence of annual species. Sites such as site 9 and site 3 have much higher nutrient levels and are therefore much better suited to supporting a number of annual species whose seed may be washed down and establish of the more fertile river flats.

Flooding which may have occurred as a result of heavy rain events may have also contributed towards influencing species richness and vegetation cover. This may happen as vegetation such are trees or growth medium is washed away or deposited within the riparian zone.

3.2.4 Threatened Ecological Communities

A list of Threatened Ecological Communities (**TECs**) occurring or potentially occurring within the locality was determined from database searches (the NSW Bionet Database Search tool and EPBC Act Protected Matters Search tool) and a literature review. Based on the results of the database searches, nine TECs have been identified as potentially occurring within the locality as outlined in Appendix 1 of the TBTR. Based on Tozer (2006) and the results of the field survey completed by Niche (2014b) and observations during the riparian monitoring (Niche, 2019d), three TECs are likely to occur in the Study Area, as listed below:

- Shale Sandstone Transition Forest – Listed as Critically Endangered under the BC Act and EPBC Act;
- Cumberland Plain Woodland – Listed as Critically Endangered under the BC Act and EPBC Act; and
- River-Flat Eucalypt Forest – Listed as Endangered under the BC Act.

During the terrestrial ecology baseline monitoring (Niche, 2019d), River-flat Eucalypt Forest, which is listed as an Endangered Ecological Community under the BC Act, occurs at control site 9. It occurs here in a highly disturbed state, with high exotic plant abundance. In Autumn 2019, site 9 was found to have the highest exotic species richness of all sampled sites. This confirmed the findings of the first year of baseline monitoring, where site 9 was found to have the highest weed abundance in both Spring and Autumn survey efforts (Niche, 2019d).

3.2.5 Threatened Flora

A total of 36 threatened flora listed on the BC Act and/or EPBC Act were identified as subject species during the Terrestrial Ecology Assessment (Niche, 2014b) which was obtained during database searches of Bionet and the EPBC Act Protected Matter Search tool, and field surveys.

As detailed by Niche (2014b), no threatened flora listed on the BC and/or EPBC Act were recorded in the Study Area. Furthermore, no threatened flora have been recorded during the riparian monitoring program to date (Niche, 2019d).

The following threatened flora which have been attributed a moderate to high likelihood of occurrence in the Terrestrial Ecology Assessment (Niche, 2014b) where are relevant to this TBTR are listed below:

- *Acacia pubescens;*
- *Epacris purpurascens* var. *purpurascens;*
- *Grevillea parviflora* subsp. *Parviflora;*
- *Leucopogon exolasius*;

- *Persoonia bargoensis;*
- *Pomaderris brunnea;*
- *Pterostylis Saxicola;*
- *Pimelea spicata;* and
- *Tetratheca glandulosa.*

3.2.6 Threatened Fauna

A total of 61 threatened fauna listed on the BC Act and/or EPBC Act were identified as subject species during the Terrestrial Ecology Assessment (Niche, 2014b) which was obtained during database searches of Bionet and the EPBC Act Protected Matter Search tool, and field surveys.

One threatened fauna species listed on the BC Act was recorded within the Study Area during Niche (2014b): The Varied Sittella which was recorded along Stonequarry Creek. The Cumberland Plain Land Snail has been recorded just outside the Study Area during a previous assessment undertaken by Niche (Niche, 2012).

After considering the habitat present in the Study Area and the results of the Terrestrial Ecology Assessment and survey (Niche, 2014b), 32 of these threatened fauna were considered to have a moderate to high likelihood of occurrence Study Area. These species include:

- Amphibians: Red-crowned Toadlet;
- Birds: Regent Honeyeater, Great Egret, Bush Stone-curlew, Gang-gang Cockatoo, Glossy Black-Cockatoo, Brown Treecreeper (eastern subspecies), Varied Sittella, Little Eagle, White-throated Needletail, Swift Parrot, Hooded Robin (south-eastern form), Black-chinned Honeyeater (eastern subspecies), Rainbow Bee-eater, Black-faced Monarch, Satin Flycatcher, Turquoise Parrot, Barking Owl, Powerful Owl, Scarlet Robin, Speckled Warbler, Rufous Fantail, Masked Owl;
- Invertebrates: Cumberland Plain Land Snail; and
- Mammals: Large-eared Pied Bat, Little Bentwing-bat, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Koala, Grey-headed Flying-fox, Greater Broad-nosed Bat.

3.2.7 Amphibian Monitoring Baseline Data

Amphibian Monitoring has been conducted over two Spring (2017/2018) and two Autumn (2018/2019) census periods at the riparian vegetation monitoring plots in Picton and Thirlmere throughout Stonequarry, Cedar and Matthews Creek (Niche, 2019d; **Figure 3-2**). The monitoring locations consisted of three impact sites and five control sites, and at each site survey was conducted along a pre-defined 200 m frog monitoring transects.

The two surveys seasons were intended to cover frogs that typically call and breed in Spring or Summer and the later surveys are intended to allow for detection of Autumn/Winter calling species as well as allowing for the detection of tadpoles and juveniles from earlier breeding. Both the target threatened frog species, Red-crowned Toadlet (*Pseudophryne australis*) and Giant Burrowing Frog (*Heleioporus australiacus*) can call over a wide period of the year, driven more by weather conditions than by the season.

Key findings for the baseline monitoring include the following:

- No threatened frog species were not detected either as frogs or tadpoles. While the study environment contains superficially suitable habitat, it is possible that the species would no longer be able to survive in the area due to predation pressures from two introduced predators: the Plague Minnow (*Gambusia holbrooki*) and the Yabbie (*Cherax destructor*) both of which were detected at all sites;
- Frog detection was relatively inconsistent due to the conditions, however, the species found at the study sites represent an otherwise normal array of 'predator aware' species for the study environments and conditions;
- There were 663 detections of individual frogs during the four frog surveys;
- There were nine species of frog recorded on sites. One additional species was noted nearby during the survey periods (Orange-groined Toadlet *Uperoleia laevigata*); and
- All sites had at least one species of frog during each survey but two sites (without surface water) recorded no frogs during the Autumn 2018 survey.

The most widespread and abundant frog species during these surveys was the Clicking Froglet (*Crinia signifera*) which was detected on all sites during the summer sample and five of the sites during the Autumn 2018 sample period. Three of the control sites had substantially higher counts of this species during the Spring 2017 count. The Striped Marsh Frog (*Limnodynastes peronii*) was also detected on all eight of the sites.

The site with the largest number of frog species was one of the control sites (F09c) although that site had low abundances of most species except the two common species already mentioned and no species were detected on the transect for site 9 in Autumn 2018. The lowest count of frogs, both by individuals and species was on an impact site at Matthews Creek (site 5) although another impact and a control site also had just 5 species.

The low frog counts observed during some surveys is almost certainly due to the dry conditions experienced prior to and during those surveys. Generally greater frog numbers were detected when there was significant rain prior to the survey or light rain with warm conditions during the survey. In at least one instance rainfall inhibited frog detection due to the extreme water noise from a rapidly flowing creek in a canyon.

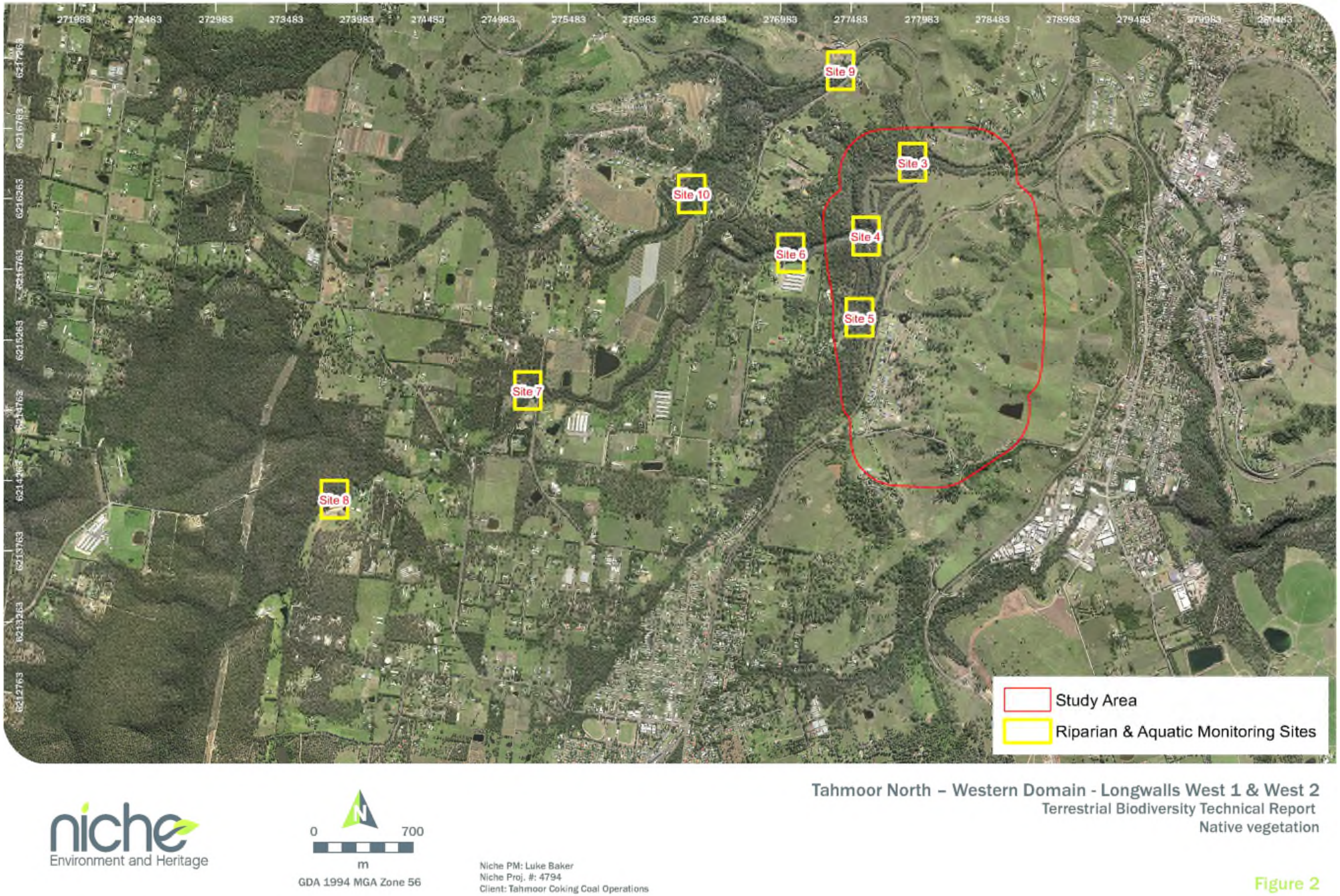

Figure 3-2 Terrestrial Ecology Monitoring Sites (Niche, 2019c)

4 Predicted Subsidence Impacts and Environmental Consequences

4.1 Aquatic Ecology

The following subsections have been sourced from the ABTR (**Appendix B**), and this report should be referred to for further detail regarding predicted subsidence impacts and environmental consequences to aquatic biodiversity.

Table 4-1 outlines the potential environmental consequences to aquatic biodiversity.

Table 4-1 Environmental Consequences to Aquatic Biodiversity

Aquatic Value	Creek System	Environmental Consequence
Aquatic Habitat	Matthews Creek	Potential reduction in pool habitat near LW W1, less than 10% reduction in overall pool habitat and increase in iron floc smothering the benthos at Cedar/Matthews Creek junction.
	Cedar Creek	Potential reduction in pool habitat near LW W1, less than 10% reduction in overall pool habitat and increase in iron floc further smothering the benthos at Cedar/Matthews Creek junction.
	Stonequarry Creek	Unlikely to have reduction in pool habitat.
Riparian Vegetation	Matthews Creek	Potential localised impacts from gas emissions, low likelihood.
	Cedar Creek	Potential localised impacts from gas emissions, low likelihood.
	Stonequarry Creek	Potential localised impacts from gas emissions, low likelihood.
Macrophytes	Matthews Creek	Potential localised reduction in available wetted habitat.
	Cedar Creek-	Potential localised reduction in available wetted habitat.
	Stonequarry Creek	Unlikely.
Macroinvertebrates	Matthews Creek	Potential reduction in available habitat and macroinvertebrate biomass. Reduction of sensitive macroinvertebrate species at Cedar Creek/Matthews Creek junction. Potential localised temporal change in community composition from episodic changes in water quality.
	Cedar Creek	Potential localised reduction in available habit and macroinvertebrate biomass. Reduction of sensitive macroinvertebrate species at Cedar Creek/Matthews Creek junction. Potential localised temporal change in community composition from episodic changes in water quality
	Stonequarry Creek	Potential localised temporal change in community composition from episodic changes in water quality.

Aquatic Value	Creek System	Environmental Consequence
Fish	Matthews Creek	Potential temporal reduction in fish passage in low flows when there is naturally limited fish passage.
	Cedar Creek-	Potential temporal reduction in fish passage in low flows when there is naturally limited fish passage.
	Stonequarry Creek	Unlikely.
Threatened Species	Matthews Creek	Unlikely.
	Cedar Creek	
	Stonequarry Creek	

4.2 Terrestrial Ecology

The following subsections have been sourced from the TBTR (**Appendix C**), and this report should be referred to for further detail regarding predicted subsidence impacts and environmental consequences to terrestrial biodiversity.

The following sections outline the potential subsidence impacts and environmental consequences to key areas of terrestrial biodiversity.

4.2.1 Vegetation

As detailed by Niche (2014b), the majority of vegetation within the Study Area would not be impacted by subsidence due to underground mining but impacts may potentially occur for riparian vegetation. Riparian vegetation potentially impacted by subsidence is generally not mapped as discrete vegetation communities, rather these areas display structural and floristic variation within their composite community in response to more frequent contact with the local water table. As such, it would be hard to distinguish impacts to truly riparian vegetation and the intergrade between riparian and woodland communities.

Vegetation which occurs on undulating lands or on ridgelines is unlikely to be impacted by subsidence. It is possible that cracking may occur within these communities, however cracking is unlikely to result in vegetation change as these communities occur in drier soils and are not ultimately reliant upon groundwater for their floristic make up or distribution.

Riparian vegetation may be impacted by subsidence through water diversion, cracking of bedrock or the release of strata gas. The overall stability of the bed and banks of overlying creeks could be indirectly affected by subsidence induced fracturing and enhanced drainage of groundwater from the banks and bed of creeks leading to loss of riparian vegetation. However, based on previous observations within the Southern Coalfields and Tahmoor North to date, such incidents have generally not occurred. Based on the present information, it is considered unlikely significant lowering of groundwater levels will occur. As only minor changes in ground water are predicted, it is unlikely significant impacts to native vegetation will occur as a result of the proposal.

MSEC (2019) states that gas emissions may occur as a result of subsidence however are rare. In the Southern Coalfield, impacts to vegetation as a result of subsidence are minor in occurrence. Previous examples of impacts include: dieback of riparian vegetation as a result of subsidence which occurred nearby Cataract River during the 1990s (Eco Logical Australia, 2004 in TEC, 1997), and small localised changes to riparian vegetation along a section of the Waratah Rivulet (HC 2007). Strata gas emissions association with subsidence are temporary, and therefore are unlikely to cause long-term adverse changes to the habitat of threatened riparian species (FloraSearch, 2009).

As detailed by Niche (2014b), impacts to vegetation associated with subsidence are unlikely, and if occurred, are likely to be localised minor floristic changes. Given MSEC (2019) reports that gas releases resulting in observable vegetation die back are not common, and in the instance where it has occurred at Tower Colliery the impacts were limited to small areas that were successfully revegetated. It is expected that any impacts to the PCTs as a result of gas emissions from the extraction of LW W1-W2 would be limited in extent and temporal in nature. In addition, as demonstrated by the sites previously affected by gas emissions, if vegetation die back was to occur, the vegetation would regenerate once the gas emissions ceased. As such, it is considered unlikely that gas emissions from subsidence would result in a decrease in the extent of the PCTs and habitat within the Study Area.

4.2.2 Destruction of Vegetation/Tree Fall by Rock Falls and Earth Slippages

The steep slopes on the sides of valleys are predominantly found in Hawkesbury Sandstone and consist of a mixture of cliffs and rock outcrops, which are stable at vertical to overhanging, and screed slopes with rocky soils and loose rock fragments. Much of these areas occur along the watercourses within the Study Area.

Slippage of earth and rocks down steep slopes and rock falls have the potential to directly impact (destroy/smother) vegetation, flora and fauna habitat as well as directly injure or kill native fauna.

Subsidence may result in the downslope movement of soils, causing tension cracks to appear at the tops of the slopes, and compression ridges to form at the bottoms of the slopes, which in turn has the potential to cause erosion (MSEC, 2019). However, as indicated by MSEC (2019), the total length of impact of cliffs that may be impacted above the longwalls amounts to approximately 25 to 35 m, and only 1% of cliffs located outside the extent of the longwalls may exhibit isolated rock falls. As such, as assessed by Niche (2014b), it is considered unlikely that any large-scale impacts to native vegetation due to earth and rock-face instability would occur. If such an event was to occur, the impacts would be localised.

4.2.3 Threatened Ecological Communities

Subsidence is unlikely to result in impacts to native vegetation that do not occur within the creeklines or immediately adjacent. This has been discussed in detailed by Niche (2014b) which has concluded that the TECs observed in the Study Area are predominately located toward the top portions of the creek valleys and therefore are unlikely to be exposed to any gas emissions from subsidence.

All the TECs that occur within the Study Area are associated with shale, alluvial and shale/sandstone transition soils which are unlikely to be subject to any biologically significant effects. As only minor changes in ground water are predicted, it is unlikely significant impacts to native vegetation will occur as a result of the proposal.

4.2.4 Flora

A detailed in the Terrestrial Ecology Assessment (Niche, 2014b), threatened flora species reliant upon watercourses, and riparian zones may be potentially impacted by subsidence. Within the Study Area, potential subsidence induced impacts may impact habitat for *Epacris purpurascens* var*. purpurascens,* and *Pomaderris brunnea*. Impacts may occur as a result of the following:

- Gas emissions from sandstone fracturing above extracted longwalls may cause die back and changes in potential habitat within riparian vegetation;
- Changes in hydrology from creek bed cracking, causing localised vegetation structure and composition changes to potential habitat; and
- Loss of individuals due to changes in hydrology, and groundwater changes.

The remainder of affected species are not likely to be reliant on any landscape feature that may be significantly affected by subsidence.

As discussed in relation to native vegetation, die-back of plants from gas emissions is a rare event. If such an event was to happen, it would be very localised, and unlikely to result in large scale die back of native flora. The likelihood for threatened flora to be located immediately adjacent to the edge of a watercourse, that may have foliage exposed to a gas emission event is considered low. Furthermore, the subject threatened flora generally occurs on the high elevations in woodland or swamp habitats that are positioned away from the watercourse bed. As such, the chances of a gas emission event affecting any potential population is considered low.

In relation to changes to water flow and standing pools, this is unlikely to affect the subject threatened flora as these species do not occur submerged, immersed or directly connected via roots to the water within pools. The drying of pools, or predicted changes to the hydrological regime to watercourses within the Study Area are therefore unlikely to result in impacts to these threatened flora species.

As discussed in relation to native vegetation, the likelihood for any large-scale impacts associated with potential rock falls/slipping of rock are low. The chances of threatened flora to be present directly in the locality of such events is considered low. As such, it is unlikely that any large-scale impacts to threatened flora due to earth and rock-face instability would occur.

As discussed in detail by Niche (2014b), based on previous experience at Dendrobium, Appin and Tower Mines within the Southern Coalfields, potential subsidence impacts are likely to have a minimal effect on vegetation composition, dispersal mechanisms, or isolation of potential populations where those vegetation communities are not dependent on surface water flows of groundwater levels. As such the Terrestrial Ecology Assessment (Niche, 2014b) concluded that subsidence impacts from the proposal are not considered likely to have a significant impact on threatened flora.

4.2.5 Fauna

As detailed in the Terrestrial Ecology Assessment (Niche, 2014b), no significant impacts to threatened fauna are expected. Given that MSEC (2019) reports that impacts are less than that provided in the Terrestrial Ecology Assessment (Niche, 2014b), it is reasonable to assume that similar impact conclusion would be reached.

As discussed by Niche (2014b) a number of threatened species are generally highly mobile, and are unlikely to have any potential habitat impacted by subsidence. These include:

- Birds: Regent Honeyeater, Great Egret, Bush Stone-curlew, Gang-gang Cockatoo, Glossy Black-Cockatoo, Brown Treecreeper (eastern subspecies), Varied Sittella, Little Eagle, White-throated Needletail, Swift Parrot, Hooded Robin (south-eastern form), Black-chinned Honeyeater (eastern subspecies), Rainbow Bee-eater, Black-faced Monarch, Satin Flycatcher, Turquoise Parrot, Barking Owl, Powerful Owl, Scarlet Robin, Speckled Warbler, Rufous Fantail, Masked Owl;
- Invertebrates: Cumberland Plain Land Snail; and
- Mammals: Koala and Grey-headed Flying Fox.

Assessments of Significance under the BC and/or EPBC Acts were carried out by Niche (2014b) for the following species:

- Amphibians: Red-crowned Toadlet; and
- Mammals: Large-eared Pied Bat, Little Bentwing-bat, Eastern Bentwing-bat, Eastern Freetail-bat, Southern Myotis, Greater Broad-nosed Bat.

As detailed by Niche (2014b) no significant impacts to these species were likely to occur based on the MSEC (2019) predictions for surface water impacts.

5 Subsidence Monitoring Program

5.1 Performance Measures and Indicators

Performance measures for aquatic and terrestrial ecology are provided in Table 1 of Condition 13A of DA 67/98 and summarised in **Table 5-1**.

Table 5-1 Subsidence Performance Measures and Performance Indicators for Biodiversity

Biodiversity Feature	Subsidence Performance Measures	Subsidence Performance Indicators
Threatened species, threatened populations, or endangered ecological communities	Negligible environmental consequences	This performance indicator will be considered to be triggered if: • Changes in macroinvertebrate and stream health indicators are statistically significant; • If visual assessment of aquatic habitat identifies mining subsidence induced impacts. • Statistically significant changes in amphibian diversity is detected toward baseline attributed to mining, as detected during amphibian monitoring; and/or • Statistically significant changes in riparian vegetation is detected toward baseline attributed to mining, as detected during riparian monitoring.

For the purpose of this Extraction Plan and associated documents, 'negligible' is defined as being 'so small and insignificant as to not be worth considering'. A negligible impact is viewed with regards to a long term context, causing little or no impact. If a short term impact causes a greater than negligible impact, the impact can still be considered negligible if the impacts are of a limited duration and are considered negligible when considered over the long term.

It is anticipated that the above performance measures will be achieved during and after mining of LW W1-W2.

5.2 Monitoring Program

A monitoring program for aquatic and terrestrial biodiversity has been compiled in **Table 5-2**, and the location of monitoring is illustrated in **Figure 3-1** and **Figure 3-2**.

The aim of the monitoring program is to identify where there is a risk of impact to landscape features and agricultural enterprises as a result of mining activities. The monitoring program provides for the opportunity to record the condition of the site during the following three phases:

- Prior to Mining – baseline survey of the condition of the site before the commencement of mining, also referred to as the baseline check;
- During Mining – monitoring of the condition of the site during active subsidence to establish whether there has been any change to the site or if changes have occurred from the effects of subsidence. This monitoring is also referred to as the post mining initial condition check; and

- Post Mining – monitoring of the condition of the site after mining to identify whether there has been any change to the site in the period since mining, and to determine if the ground surface conditions have stabilised. This monitoring is also referred to as the post mining secondary condition check.

If an impact is identified to have occurred or is likely to occur, the TARP (refer to **Appendix A**) should then be referred to for the identification of appropriate mitigation strategies.

Table 5-2 Monitoring Program for Biodiversity Features

<table>
<tr><th rowspan="2">Feature</th><th rowspan="2">Monitoring Component / Location</th><th colspan="3">Monitoring</th></tr>
<tr><th>Prior to Mining</th><th>During Mining</th><th>Post Mining</th></tr>
<tr><td>Water quality</td><td>Physio chemical water quality sampling at all aquatic ecology monitoring sites (sites 4-16)</td><td rowspan="4">Completed as part of baseline monitoring.</td><td rowspan="4">Bi-annually (first occurring in Spring 2019)</td><td rowspan="4">Bi-annually (Spring and Autumn for 3-5 years)</td></tr>
<tr><td>Aquatic habitat</td><td>Aquatic habitat observations at aquatic ecology monitoring sites 4-8</td></tr>
<tr><td rowspan="2">Macroinvertebrates</td><td>AUSRIVAS macroinvertebrate sampling at aquatic ecology monitoring sites 4-8</td></tr>
<tr><td>Quantitative macroinvertebrate sampling at aquatic ecology monitoring sites 4-16</td></tr>
<tr><td>Riparian vegetation</td><td>Permanent vegetation plots, vegetation condition assessment, photo-point monitoring and plant taxonomy at all riparian vegetation monitoring sites (sites 3-10)</td><td>Completed as part of baseline monitoring.</td><td>Bi-annually (first occurring in Spring 2019)</td><td>Bi-annually (Spring and Autumn for 3-5 years)</td></tr>
<tr><td>Amphibians</td><td>Amphibian monitoring and photo-point monitoring at all amphibian monitoring sites (sites 3-10)</td><td>Completed as part of baseline monitoring.</td><td>Bi-annually (Spring and Autumn, with the first occurring in Spring 2019)</td><td>Bi-annually (Spring and Autumn for 3-5 years)</td></tr>
</table>

5.3 Further Baseline Monitoring

To assist in the preparation of future Extraction Plans, the aquatic and terrestrial ecology monitoring as outlined in **Table 5-2** will provide sufficient baseline data to assist the preparation of the Extraction Plan for LW W3-W4. Monitoring data collected during the mining of LW W1-W2 would be used in the review of observed subsidence impacts for future Extraction Plans.

The monitoring program going forward should aim to be consistent with baseline monitoring conducted in 2017-2019 (Niche, 2019a; Niche, 2019c). The program should also adapt to changing priorities, mine design and/or include improvements to overall design of the monitoring program. This may involve addition or removal of sites and/or indicators as necessary to streamline and detect meaningful ecological change.

The program should be reviewed particularly after the completion of the first longwall (W1), to ascertain whether survey effort is effectively monitoring stream health and anthropogenic induced changes and inform future mine layout.

6 Subsidence Management Strategies

6.1 Mine Design Considerations

Tahmoor Coal previously submitted a Subsidence Management Plan Application (SMP Application) for Longwalls 31 to 37 (LW31-37) in the Bulli Coal Seam in December 2014, which included longwalls in the Western Domain. The current mine plan is a revision of this SMP Application mine plan, which was reviewed based on many factors including feedback received from the community following submission of the SMP Application in 2014 and additional information gathered from underground conditions, which influenced the orientation of the proposed longwalls (MSEC, 2019). The current mine design has been designed specifically in response to the sensitive surface features of the environment in order to avoid significant impact. Further discussion of mine design considerations is provided in **Section 3.6.1** of the Extraction Plan Main Document.

The current mine plan proposes to continue underground mining operations by the underground mining operations through the extraction of LW W1-W2 in the Western Domain, to the north of the currently active longwall series. The proposed LW W1-W2 are located to the west of the township of Picton, between Matthews, Cedar and Stonequarry Creeks, the Main Southern Railway and the currently active longwall series (refer to **Figure 1-2**).

6.2 Trigger Action Response Plan

A TARP has been developed using the performance indicators for management of biodiversity as a result of LW W1-W2 mining (refer to **Appendix A**). Where performance indicators indicate that a level of risk has been triggered greater than a normal level (Levels 2 and 3 with escalating corresponding risk), a response in the form of management / corrective actions is required to be implemented as outlined in the TARP.

6.3 Contingency Plan

In the event that performance measures are considered to have been exceeded or are likely to be exceeded, a response will be undertaken in accordance with the TARP provided in **Appendix A**. This response is a contingency plan that describes the management / corrective actions which can be implemented where required to remedy the exceedance.

If a Corrective Management Action Plan is required in accordance with the TARP, this plan will be prepared in accordance with **Section 3.6.3** of the Extraction Plan Main Document. The success of remediation measures that has been implemented for any TARP exceedance would be reviewed as part of any Corrective Action Management Plan, the Annual Review (refer to **Section 6.1.5** of the Extraction Plan Main Document), and the End of Panel Report for each longwall.

6.4 Adaptive Management

An Adaptive Management Strategy has been proposed to review mining-induced ground movement and impacts on the streams in proximity to LW W1 (particularly Cedar Creek and Stonequarry Creek) to inform considerations for the amendment of the commencing position of LW W2. This strategy is discussed in more detail in **Section 3.6.4** of the Extraction Plan Main Document.

While impacts to biodiversity will be considered as part of the overall Adaptive Management Strategy, there are no adaptive management strategies proposed specifically to manage impacts to biodiversity.

7 Review and Improvement

This section of the BMP describes the key elements of implementation relevant to biodiversity. A description of general reporting requirements, reviews and key responsibilities that are applicable to extraction of LW W1-W2 are discussed in the Extraction Plan Main Document.

7.1 Reporting Requirements

Generic reporting requirements for the LW W1-W2 Extraction Plan are discussed in **Section 6.1** of the Extraction Plan Main Document. There are no reporting requirements specific to biodiversity identified for the extraction of LW W1-W2.

7.2 Review and Auditing

Generic review and auditing requirements for the LW W1-W2 Extraction Plan are discussed in **Section 6.2** of the Extraction Plan Main Document. There are no review or auditing requirements specific to biodiversity identified for the extraction of LW W1-W2.

7.3 Roles and Responsibilities

Generic roles and responsibilities applicable for the implementation of the LW W1-W2 Extraction Plan are discussed in **Section 6.3** of the Extraction Plan Main Document. There are no roles and responsibilities specific to the implementation of biodiversity management measures identified for the extraction of LW W1-W2.

8 Document Information

This section provides a compiled list of references, related documents, terms, and abbreviations used in this document. In addition, this section provides the change information for this document.

8.1 References

Eco Logical Australia (2004), The Impacts of Longwall Mining on the Upper Georges River Catchment: Report to Total Environment Centre, 2004.

FloraSearch (2009), Illawarra Coal Bulli Seam Operations Project Terrestrial Flora Assessment, prepared for BHP Billiton Illawarra Coal.

GeoTerra (2014), Tahmoor Coal PTY LTD - Tahmoor colliery Longwall Panels 31 to 37 Streams, Dams & Groundwater Assessment Tahmoor, NSW.

Hydro Engineering & Consulting (2019), Extraction Plan LW W1 – W2. Surface Water Technical Report. Prepared for Tahmoor Coking Coal Operations. Dated 8 May 2019.

Mine Subsidence Engineering Consultants (2019), SIMEC Mining: Tahmoor Coking Coal Operations – Longwalls W1 and W2. Subsidence Predictions and Impact Assessments for Natural and Built Features due to the Extraction of the Proposed Longwalls W1 and W2 in Support of the Extraction Plan Application. Prepared for Tahmoor Coking Coal Operations. Dated April 2019.

Niche (2014a), Aquatic assessment – Tahmoor North -Longwalls 31-37. Prepared for Tahmoor Coal.

Niche (2014b), Tahmoor North Longwalls 31 to 37 Terrestrial Ecology Assessment- Prepared for Tahmoor Coal December 2014

Niche (2019a), Tahmoor North – Western Domain Longwalls West 1 and West 2, Aquatic Biodiversity Technical Report, prepared for Tahmoor Coal.

Niche (2019b), Tahmoor North – Western Domain, Aquatic Ecology Baseline Monitoring Report, prepared for Tahmoor Coal.

Niche (2019c), Tahmoor North – Western Domain Longwalls West 1 and West 2, Terrestrial Biodiversity Technical Report, prepared for Tahmoor Coal.

Niche (2019d), Tahmoor North – Western Domain, Terrestrial Ecology Baseline Monitoring Report, prepared for Tahmoor Coal.

NPWS (2002), Cumberland Plain Vegetation Mapping Project and Tozer (2006) Native vegetation of southeast NSW.

8.2 Glossary of Terms

The Extraction Plan Main Document provides a compiles Glossary of Terms in **Section 8.3**.

8.3 Abbreviations

Abbreviations used in this document are provided below in **Table 8-1**.

Table 8-1 Abbreviations

Abbreviation	Definition
ABTR	Aquatic Biodiversity Technical Report
AUSRIVAS	Australian River Assessment System
BACI	Before After Control Impact
BC Act	*Biodiversity Conservation Act 2016*
BMP	Biodiversity Management Plan
CEEC	Critically Endangered Ecological Communities
CTF	Cease to flow
DPE	Department of Planning and Environment
EEC	Endangered Ecological Communities
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPT	Ephemeroptera, Plecoptera, Trichoptera – a macroinvertebrate index of stream health.
GFG	GFG Alliance
HEC	Hydro Engineering & Consulting
km	Kilometre/s
LW	Longwall
LW W1	Longwall West 1
LW W1-W2	Longwalls West 1 to West 2
LW W2	Longwall West 2
LW W3-W4	Longwalls West 3 to West 4
LW W4	Longwall West 4
m	Metre/s
mm	Millimetre/s
ML	Mining Lease
Macrophytes	Aquatic vegetation
MNES	Matters of national environmental significance
MSEC	Mine Subsidence Engineering Consultants
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
RCE	Riparian Channel and Environment Inventory;
ROM	Run of Mine
SIGNAL	'Stream Invertebrate Grade Number – Average Level' is a simple biotic index for macroinvertebrates that uses the pollution tolerance levels of different macroinvertebrate types to create a site score and water quality rating for the river, creek or pond being studied.

Abbreviation	Definition
SIMEC	SIMEC Mining Division
SMP	Subsidence Management Plan
Tahmoor Coal	Tahmoor Coal Pty Ltd
Tahmoor Mine	Tahmoor Coal Mine
TARP	Trigger Action Response Plan
TBTR	Terrestrial Biodiversity Technical Report
TCCO	Tahmoor Coking Coal Operations
TECs	Threatened Ecological Communities

8.4 Change Information

Table 8-2 provides the details of document history of this BMP.

Table 8-2 Document History

Version	Date Reviewed	Reviewed By	Change Summary
1.0	July 2019	Ron Bush	New document

Appendix A – Trigger Action Response Plan

Trigger Action Response Plan – Biodiversity Management Plan

<table>
<tr><th rowspan="2">Feature</th><th colspan="2">Management</th></tr>
<tr><th>Trigger</th><th>Action</th></tr>
<tr><td rowspan="6">Decline or significant negative change in macroinvertebrate indicators. These indicators include:
• Density
• Family richness
• Community assemblages
• EPT index
• SIGNAL score
• AUSRIVAS score</td><td colspan="2">Normal</td></tr>
<tr><td>• Monitoring macroinvertebrate indicators are within range of baseline data as supported by statistical analysis.</td><td>• Continue subsidence monitoring program and biodiversity monitoring program.</td></tr>
<tr><td colspan="2">Within Prediction</td></tr>
<tr><td>• One or more macroinvertebrate indicators are not within range of baseline data as supported by statistical analysis.
AND ONE OR BOTH OF THE FOLLOWING:
• Subsidence monitoring program identifies potential for impact to watercourse parameters associated with aquatic habitat areas compared to baseline (e.g. cracking).
• Surface monitoring program identifies potential impacts to hydrology/water quality parameters compared to baseline.</td><td>• Continue monitoring programs.
• Review and confirm monitoring data, cross check aquatic biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger.
• Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related.
• Assess need for any increase to monitoring frequency or additional monitoring where relevant.</td></tr>
<tr><td colspan="2">Exceeds Prediction</td></tr>
<tr><td>• Monitoring indicates that three or more macroinvertebrate indicators are not within range of baseline data as supported by statistical analysis.
AND ONE OR BOTH OF THE FOLLOWING:
• Subsidence monitoring identifies mining induced impacts compared to baseline watercourse parameters associated with aquatic habitat (e.g. cracking).
• Surface monitoring program identifies significant impacts to hydrology/water quality that exceed predictions compared to baseline.</td><td>• Convene Tahmoor Coal Environmental Response Group to review response.
• Implement Adaptive Management process as detailed within the Extraction Plan.
• Notify OEH and relevant stakeholders within 7 days of current findings and proposed approach for investigation upon identification of the potential trigger;
• Provide written Status Report to NSW Resources Regulator – Director Compliance Operations within 4 weeks of notification reviewing requirement, need and potential cost/benefit of preparation and implementation of a corrective action management plan.
• Investigate the potential cause / fate of any biodiversity level trigger exceedance.
• Report notification in End of Panel report and Annual Review.</td></tr>
</table>

<table>
<tr><th rowspan="2">Feature</th><th colspan="2">Management</th></tr>
<tr><th>Trigger</th><th>Action</th></tr>
<tr><td rowspan="6">Reduction in aquatic habitat though loss of pools or associated reduction in water quality (AUSRIVAS habitat assessment).</td><td colspan="2">Normal</td></tr>
<tr><td>• Visual monitoring indicates aquatic habitat parameters are similar to baseline observations at aquatic ecology monitoring sites.</td><td>• Continue subsidence monitoring program and aquatic biodiversity monitoring program.</td></tr>
<tr><td colspan="2">Within Prediction</td></tr>
<tr><td>• Visual monitoring indicates potential change in aquatic habitat compared to baseline observations at aquatic ecology monitoring sites.
AND ONE OR BOTH OF THE FOLLOWING:
• Subsidence monitoring identifies potential for impact to watercourse parameters associated with macroinvertebrate indicators compared to baseline.
• Surface monitoring program identifies potential for impact to hydrology/water quality parameters compared to baseline.</td><td>• Continue monitoring programs.
• Review and confirm monitoring data, cross check aquatic biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger.
• Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related.
• Assess need for any increase to monitoring frequency or additional monitoring where relevant.</td></tr>
<tr><td colspan="2">Exceeds Prediction</td></tr>
<tr><td>• Visual monitoring indicates a significance change in aquatic habitat compared to baseline observations at aquatic ecology monitoring sites.
AND ONE OR BOTH OF THE FOLLOWING:
• Subsidence monitoring identifies potential for impact to watercourse parameters associated with macroinvertebrate indicators compared to baseline.
• Surface monitoring program identifies potential for impact to hydrology/water quality parameters compared to baseline.</td><td>• Convene Tahmoor Coal Environmental Response Group to review response.
• Implement Adaptive Management process as detailed within the Extraction Plan.
• Notify OEH and relevant stakeholders within 7 days of current findings and proposed approach for investigation upon identification of the potential trigger.
• Provide written Status Report to NSW Resources Regulator – Director Compliance Operations within 4 weeks of notification reviewing requirement, need and potential cost/benefit of preparation and implementation of a corrective action management plan.
• Investigate the potential cause / fate of any biodiversity level trigger exceedance.
• Report notification in End of Panel report and Annual Review.</td></tr>
</table>

Feature	Management	
	Trigger	Action
Decline in amphibian populations within watercourses of the Study Area	Normal	
	• Monitoring indicates amphibian population parameters are predominantly within a reasonable range of baseline data as supported by statistical analysis.	• Continue subsidence monitoring program and biodiversity monitoring program.
	Within Prediction	
	• Monitoring indicates amphibian population parameters are predominantly not within a reasonable range of baseline data as supported by statistical analysis. AND • Subsidence monitoring program identifies potential for impact of watercourse parameters associated with sensitive amphibian habitat areas compared to baseline.	• Continue monitoring programs. • Review and confirm monitoring data, cross check biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related. • Assess need for any increase to monitoring frequency or additional monitoring where relevant.
	Exceeds Prediction	
	• Monitoring indicates amphibian population parameters are significantly not within a reasonable range of baseline data as supported by statistical analysis. AND • Mining induced impacts (exceeds predicted compared to baseline) for watercourse parameters associated with sensitive amphibian habitat are identified by environmental monitoring.	• Convene Tahmoor Coal Environmental Response Group to review response. • Notify OEH and relevant stakeholders within 7 days of current findings and proposed approach for investigation upon identification of the potential trigger. • Provide written Status Report to NSW Resources Regulator – Director Compliance Operations within 4 weeks of notification reviewing requirement, need and potential cost/benefit of preparation and implementation of a corrective action management plan. • Investigate the potential cause / fate of any biodiversity level trigger exceedance. • Report notification in End of Panel report and Annual Review.

Feature	Management	
	Trigger	Action
Dieback of riparian vegetation within watercourses of the Study Area	Normal	
	• Monitoring indicates riparian vegetation parameters are predominantly within a reasonable range of baseline data as supported by statistical analysis.	• Continue subsidence monitoring program and biodiversity monitoring program.
	Within Prediction	
	• Monitoring indicates riparian vegetation parameters are predominantly not within a reasonable range of baseline data as supported by statistical analysis. AND • Subsidence monitoring program identifies potential for impact of watercourse parameters associated with sensitive riparian habitat areas.	• Continue monitoring programs. • Review and confirm monitoring data, cross check Biodiversity monitoring data against other related environmental data (e.g. control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related. • Assess need for any increase to monitoring frequency or additional monitoring where relevant.
	Exceeds Prediction	
	• Monitoring indicates riparian vegetation parameters are significantly not within a reasonable range of baseline data as supported by statistical analysis. AND • Mining induced impacts (exceeds predication compared to baseline) for watercourse parameters associated with riparian vegetation are identified by environmental monitoring.	• Convene Tahmoor Coal Environmental Response Group to review response. • Notify OEH and relevant stakeholders within 7 days of current findings and proposed approach for investigation upon identification of the potential trigger. • Provide written Status Report to NSW Resources Regulator – Director Compliance Operations within 4 weeks of notification reviewing requirement, need and potential cost/benefit of preparation and implementation of a corrective action management plan. • Investigate the potential cause / fate of any biodiversity level trigger exceedance. • Report notification in End of Panel report and Annual Review.

Appendix B – Aquatic Biodiversity Technical Report

Appendix C – Terrestrial Biodiversity Technical Report