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Subsidence Impacts on Threatened Flora Species on Waratah Rivulet and the Eastern Tributary



Assessments of Impact on Threatened Flora. Metropolitan Colliery, Helensburgh, NSW

Assessment of Impacts on Threatened Flora on Waratah Rivulet and the Eastern Tributary, March 2020

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1 Introduction

In accordance with the Longwalls 301-303 Biodiversity Management Plan (BMP), the exceedance of any biodiversity subsidence impact performance indicator triggers an assessment against the biodiversity subsidence impact performance measure: '*Negligible impact on threatened species, populations, or ecological communities*', where *Negligible* is defined in the Project Approval as '*small and unimportant such as to be not worth considering*'.

Bio Analysis Pty Ltd monitors aquatic biota (macroinvertebrates and macrophytes) biannually in autumn and spring in streams within the Project area and surrounds. Aquatic ecology monitoring results are assessed by Bio Analysis Pty Ltd against the following aquatic biota performance indicator:

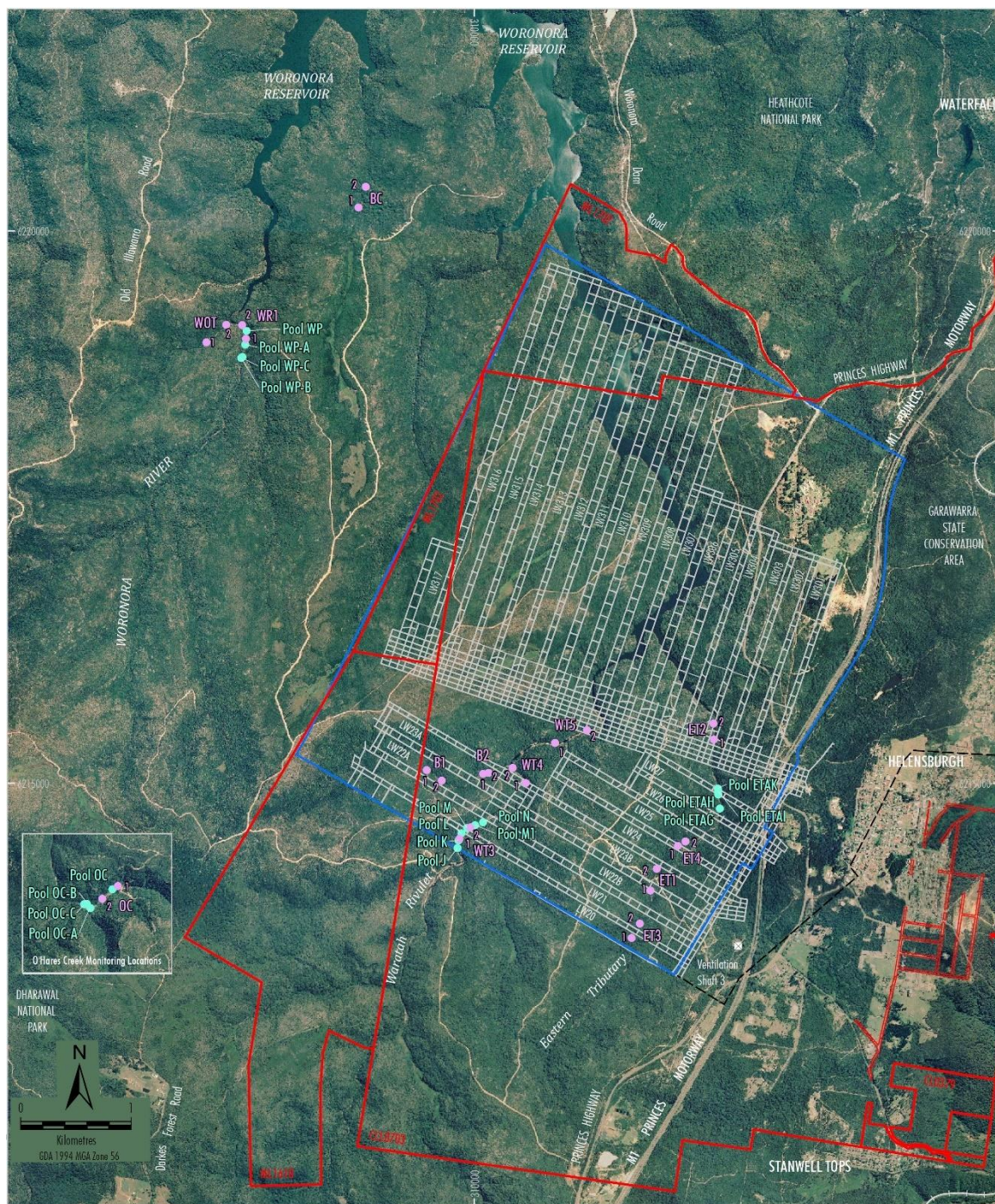
The aquatic macroinvertebrate and macrophyte assemblages in streams and pools are not expected to experience long-term impacts as a result of mine subsidence.

In accordance with the Longwalls 301-303 BMP, the threatened flora assessments of aquatic ecology monitoring locations have been triggered by the exceedance of the aquatic ecology performance indicator at five locations on the Waratah Rivulet and one location on the Eastern Tributary. Specifically, the aquatic ecology performance indicator has been exceeded at the following locations in spring 2018 and/or autumn 2019 (**Figure 1**):

- Smaller pools K, L and M on the Waratah Rivulet, due to a significant change in mean diversity of macroinvertebrates which has persisted for more than three years.
- Larger pools M1 and N on the Waratah Rivulet, due to a decrease in the mean cover of macrophytes, and increased variability in the diversity of macrophytes, respectively, which have persisted for more than three years.
- Stream monitoring site ET1 on the Eastern Tributary, due to increased variability in the numbers of Leptophlebiidae, which has persisted for more than three years.

Ms Elizabeth Norris (Ecoplaning Pty Ltd) was commissioned by Metropolitan Coal to undertake an assessment of the subsidence impacts on threatened flora that may be associated with aquatic ecology monitoring pool Sites K, L, M and M1 on the Waratah Rivulet, and at stream Site ET1 on the Eastern Tributary. Site inspections were undertaken on 5, 10 and 11 March 2020.

This report is the first threatened flora species assessment report for prepared for the aquatic ecology monitoring locations listed above.



LEGEND

- Mining Lease Boundary
- Railway
- Project Underground Mining Area
- Longwalls 20-27 and 301-317
- Existing Underground Access Drive (Main Drift)

Monitoring

- Pool Aquatic Ecology Sampling Site
- Stream Aquatic Ecology Sampling Site

Source: Land and Property Information (2015); Date of Aerial Photography 1998;
Department of Industry (2015); Metropolitan Coal (2019)

Peabody
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Aquatic Ecology Monitoring Locations

Figure 1

Figure 1: Aquatic Monitoring Sites

2 Potential Threatened Flora

Four threatened flora species listed under the *NSW Biodiversity Conservation Act 2016* (BC Act) (previously the *NSW Threatened Species Conservation Act, 1995*) were recorded in the baseline flora survey for the Project Area (Bangalay Botanical Surveys 2008), viz.

- *Acacia bynoeana* (Bynoe's Wattle)
- *Astrotricha crassifolia* (Thick-leaf Star-hair)
- *Melaleuca deanei* (Deane's Paperbark)
- *Pultenaea aristata* (Prickly Bush-pea)

Two threatened species (unconfirmed collections reported in the baseline flora survey of Bangalay Botanical Services 2008) also have the potential to occur in the Project Area;

- *Epacris purpurascens* var. *purpurascens*
- *Leucopogon exolasius* (Woronora Beard-heath)

Two additional threatened flora species, *Acacia baueri* subsp. *aspera* and *Cryptostylis hunteriana* (Leafless Tongue Orchid), have been recorded within the Project Area or surrounds since the baseline surveys by Eco Logical Australia.

Of these, three threatened flora species, *Astrotricha crassifolia*, *Pultenaea aristata* and *Leucopogon exolasius*, are known or have the potential to occur adjacent to or in riparian vegetation.

As described in the Longwalls 301-303 BMP, no threatened aquatic flora listed under the *Fisheries Management Act, 1994*, BC Act or *Environment Protection and Biodiversity Conservation Act, 1999* have been recorded within the Project underground mining area or in the Woronora Reservoir. Therefore, this assessment has been prepared with regard to the terrestrial threatened flora described below which are known or have the potential to occur adjacent to or in riparian vegetation.

Astrotricha crassifolia occurs in dry sclerophyll woodland on sandstone (Dept of Planning, Infrastructure and Environment [DPIE] 2020a). It occurs on ridgetops on the Patonga Plateau north of Sydney, and in the Royal National Park and on the Woronora Plateau south of Sydney (Warman & Beckers 2011, Benson & McDougall 1993). In the Project Area it most often occurs in dry sclerophyll woodland on mid to lower slopes including adjacent to riparian scrub (Norris pers. obs.). One individual was recorded at riparian site MRIP07 (along the Eastern Tributary, downstream of Longwall 27) in all survey seasons inclusive of spring 2008 to autumn 2012 riparian vegetation surveys, however, has not been recorded at this site since spring 2012 due to flood impacts undermining the root zone of this individual (pers. obs.).

A population of *Astrotricha crassifolia* (some 55 individuals) was recorded in the vicinity of and downstream of riparian vegetation monitoring site MRIP12 (Eco Logical Australia, 2017b). Most individuals were recorded on lower slopes, above the riparian zone, however some (14 individuals) were also recorded in the riparian zone. *Astrotricha crassifolia* has not been recorded within riparian vegetation monitoring sites on the Waratah Rivulet.

Pultenaea aristata is endemic to the Woronora Plateau and is often associated with upland swamp vegetation communities and in wet heath and shrubby sclerophyll woodland (Benson & McDougall 1996; DPIE 2020b). It is also known to occur in association with areas of impeded drainage and creek lines with sandstone woodland and gully forest communities. (DPIE 2020b). It's a widespread and common species within the Project Area and surrounds (Bangalay Botanical Surveys, 2008). This species has not been recorded within monitoring sites on the Waratah Rivulet or Eastern Tributary or within areas affected by dieback which are regularly traversed as part of the flora monitoring program (Ecological Australia various dates). A small population of *Pultenaea aristata* occurs above the riparian zone adjacent to the Eastern Tributary in the vicinity of Fire Trail 9J crossing.

Leucopogon exolasius generally occurs in woodland on sandstone (DPIE 2020c), in sparsely vegetated sand deposits, or on rocky sandstone hillsides near creeks (Benson & McDougall 1993). This species has not been recorded within monitoring sites on the Waratah Rivulet or Eastern Tributary, or within the areas affected by dieback which are regularly traversed as part of the flora monitoring program (Eco Logical Australia various dates).

No threatened flora populations or critical habitat have been listed for the Waratah Rivulet and the Eastern Tributary, or any other streams on the Woronora Plateau.

2.1 Key Assessment Considerations

Consistent with the Longwalls 301-303 BMP, factors to be taken into consideration in the assessment of threatened species are as follows:

Key Assessment Considerations

1. *What is the nature of the environmental consequence (e.g. the potential for adverse impacts on upland swamps, riparian vegetation, slopes and ridgetops or aquatic habitats)?*
2. *What are the potential factors that may have contributed to the environmental consequence (e.g. the degree of subsidence effects, ineffective management measures or prevailing climatic conditions)?*
3. *Which threatened species have the potential to be impacted?*
4. *What are the potential impacts on the lifecycle of the potential threatened species (e.g. foraging, breeding/reproduction, nesting, shelter and movement/dispersal)?*
5. *What are the potential impacts on the habitat of the potential threatened species (e.g. area affected)?*
6. *Has the habitat connectivity of the threatened species been affected (e.g. loss of stream pool habitat connectivity)?*
7. *What actions, if any, are most appropriate to mitigate the impacts and/or to minimise future impacts?*

3 Background

3.1 Climatic Conditions

Error! Reference source not found. provides the monthly rainfall data from the Helensburgh 2 Metropolitan Coal Weather Station located approximately 3 km east of the Project Area, for the period September 2008 to 10 March 2020.

Following the autumn 2019 inspections of the aquatic ecology monitoring locations (Bio-Analysis 2020a, 2020b), monthly rainfall from March 2019 through to March 2020 continued to be well below the long-term mean recorded at Darkes Forest (with the exception of March 2019 when close to average monthly rainfall was recorded) (**Table 1**). Above average rainfall was recorded in September 2019 followed by three months of well below average rainfall particularly for December 2019. February 2020 recorded well above average rainfall prior to the March 2020 site inspection.

Table 1: Monthly rainfall (mm) for survey period (September 2008 to March 2020)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2008									89.0	53.5	64.5	82.0
2009	35.5	210.0	102.0	155.5	152.5	80.5	55.5	5.0	26.0	120.5	63.5	63.5
2010	37.0	182.5	118.5	30.5	89.5	169.0	47.5	43.0	173.5	75.0	103.5	90.5
2011	42.0	4.0	164.5	59.5	51.0	167.0	169.5	91.0	75.0	80.0	162.5	76.0
2012	180.5	242.0	235.5	117.5	15.0	129.5	45.5	5.5	22.5	63.5	54.5	28.0
2013	171.0	220.5	67.0	104.5	106.5	283.5	7.0	11.0	80.5	12.0	217.5	54.5
2014	31.5	50.5	218.5	59.0	11.5	28.0	8.0	93.0	25.5	79.5	39.5	182.5
2015	113.5	96.0	32.5	445.0	101.5	62.5	53.0	81.5	38.5	30.5	119.0	60.5
2016	275.0	31.0	46.5	55.5	36.0	394.5	92.5	84.0	52.5	15.5	36.0	67.5
2017	63.0	172.0	404.5	70.0	13.5	174.5	12.5	18.5	0.5	37.0	39.0	52.5
2018	37.0	86.0	141.5	19.5	11.0	97.0	1.0	16.0	41.0	175.5	117.0	93.5
2019	56.0	40.0	152.0	27.0	9.0	104.0	48.5	54.0	139.5	37.0	48.0	7.0
2020	106.5	540.0	80.0 ²									
Mean	131.2	159.6	154.3	126.1	128.1	145.8	96.0	88.9	77.2	91.5	104.9	103.0

¹ Mean data sourced from Bureau of Meteorology Station Number 068024 (Darkes Forest – Kintyre) (www.bom.gov.au March 2020). Highlighted data refers to current reporting period, with March 2019 about average and September 2019 well above average.

² Rainfall to March 10, 2020

December 2018 to December 2019 continued to experience well below average rainfall across the Project Area with the exception of March and September 2019 when close to average and well above average rainfall was recorded respectively. Overall, 2019 was the hottest year on record with above average temperatures recorded in conjunction with very low rainfall (BOM 2020).

3.2 Aquatic Ecology Monitoring on the Waratah Rivulet and the Eastern Tributary

Aquatic ecology monitoring is conducted biannually at a range of pool and stream monitoring sites in accordance with the approved monitoring program specified in the Longwalls 301-303 BMP.

3.3 Site Inspections

Inspection of the riparian vegetation corridors occurring along Waratah Rivulet and the Eastern Tributary adjacent to the aquatic ecology monitoring sites indicated that a number of shrubs and ground layer species have been recently flood impacted with flood-swept and prone vegetation commonly observed. A review of rainfall data (Error! Reference source not found.) indicated that February 2020 received over three times the average monthly rainfall over several consecutive days and has contributed to the flood impacts observed to streamside vegetation and sediments during the current site inspection.

3.3.1 Waratah Rivulet – Pools K, L M, M1 and N

At the time of inspection, water flow was continuous through all pools and over rock bars with an in-stream iron precipitate/micro-organism complex (herein referred to as floc) and green algae present on rocky surfaces (e.g. Pool L area).

The main impacts to vegetation were found across the boulder field and stream edges of Pool N where a number of small tree and shrub species were found fully prone particularly across the boulder field. Streamside bank scouring and erosion, and sediment deposition continues to occur on either side undermining the stream bank causing some vegetation loss. The access track along the east bank is also disappearing in part and becoming eroded in other areas where water can pool.

Further upstream in the vicinity of Pools K, L, M, M1 the riparian vegetation has been less impacted by high water flows. Several shrub species were also found to be prone and displayed minor dieback (yellowing leaves) including *Banksia ericifolia* subsp. *ericifolia* and *Acacia obtusifolia*. Groundlayer species were more impacted by high water flows including *Bauera rubioides*, *Schoenus melanostachys* and *Lomandra fluviatilis*.

Areas of sediment erosion were also observed along Pools K, L, M with most occurring along the edges of Pool M and M1 where plants roots have been eroded and exposed. Sediment deposition is also present across streamside rock bars.

No threatened flora species were observed or are known to occur adjacent to Pools K, L, M, M1 and N. Two RoTAP¹ species *Hibbertia nitida* and *Lomandra fluviatilis* occur sporadically along either side of Waratah Rivulet. *Lomandra fluviatilis* was flood-swept in areas with minor dieback of leaves observed. Most *Hibbertia nitida* were observed in a healthy condition although some plants have been impacted by high water flows resulting from the heavy rains during February 2020. These plants were often found to be prone and contained flood debris remnants in branches.

¹ RoTAP: Rare or Threatened Australian Plant (Briggs and Leigh 1995)

3.3.2 Eastern Tributary –Stream Monitoring Site ET1

ET1-1

At the time of inspection, steady water flow was continuous over the crossing at Fire Trail 9J with the upstream Pool ET1-1 full. Stream water appeared yellow brown in colour and cloudy, with in-stream floc coating rocky surfaces and woody debris. A small tributary draining into Pool ET1-1 was flowing and evidence of bank scouring is present.

Riparian vegetation was flood-swept in appearance but generally observed in good condition. The shrub *Banksia ericifolia* subsp. *ericifolia* and ground layer sedge *Schoenus melanostachys* displayed minor dieback with yellowing leaves.

Individuals of *Pultenaea aristata* occur sporadically in the vicinity of ET1-1 and all were found to be in a healthy condition. A population of *Pultenaea aristata* has been recorded further downstream of ETA 1-1 on the western slopes above the Eastern Tributary in the vicinity of Fire Trail 9J (Eco Logical Australia 2017a). Several individuals appeared to be in a senescent state whilst others inspected were found to be in good health.

The RoTAP species *Hibbertia nitida* also occurs sporadically in the vicinity of ET1-1 and individuals were found to be in a healthy condition.

ET1-2

Site ET1-2 has been severely impacted by high water flows with large woody flood debris tangled amongst prone small trees, shrubs and ground layer species, with some vegetation prone across the pool. Most of the streamside shrub and groundlayer vegetation was flood-swept and prone and where caught underwater, was covered in floc.

Severe bank erosion and sand and gravel deposition is also present along the western streamside, with roots of groundlayer vegetation eroded and exposed. Loss of litter cover has also occurred, and small areas of bank edge appear to be slumping.

No threatened flora species were observed or are known to occur in the vicinity of Site ET1-2.

4 Assessment

This section briefly addresses each of the key assessment considerations identified in the Longwalls 301-303 BMP as they relate to the condition of the vegetation and any impacts to potential threatened flora observed on 5 March 2020 along Waratah Rivulet and 10 and 11 March 2020 along the Eastern Tributary.

4.1 Waratah Rivulet and the Eastern Tributary

1. **What is the nature of the environmental consequence?**

The observed changes at smaller pools K, L and M (a significant change in mean diversity of macroinvertebrates) and larger pools M1 and N (a decrease in the mean cover of macrophytes, and increased variability in the diversity of macrophytes, respectively) would indicate an impact from mining (Bio-Analysis 2020a, 2020b).

The observed changes at stream monitoring site ET1 on the Eastern Tributary would indicate an impact from mining, namely the increased variability in the numbers of Leptophlebiidae.

At the time of the March 2020 site inspection, impacts to terrestrial shrubs and ground cover species within the riparian zone along Waratah Rivulet and the Eastern Tributary appear to be as a result of high energy water flows following the heavy rains of February 2020. Impacts that may have resulted from changes in aquatic habitat and or hydrology prior to this event are uncertain.

2. **What are the potential factors that may have contributed to the environmental consequence?**

See '1' above.

3. **Which threatened species have the potential to be impacted?**

As described in **Section 2**, no threatened aquatic flora listed under the *Fisheries Management Act, 1994*, BC Act or *Environment Protection and Biodiversity Conservation Act, 1999* have been recorded within the Project underground mining area or in the Woronora Reservoir.

Three threatened terrestrial flora species have the potential to occur adjacent to or in the riparian areas in the vicinity of the aquatic ecology monitoring locations, namely *Astrotricha crassifolia*, *Pultenaea aristata* and *Leucopogon exolasius* (**Section** Error! Reference source not found. above).

Despite extensive surveys, *Astrotricha crassifolia*, *Pultenaea aristata* and *Leucopogon exolasius* are not known to occur in the riparian vegetation along Waratah Rivulet in the vicinity of the aquatic monitoring sites. Similarly, *Leucopogon exolasius* is not known to occur in the riparian vegetation along the Eastern Tributary in the vicinity of the monitoring sites.

A population of *Pultenaea aristata* is known to occur in the vicinity of ET1-1 along the Eastern Tributary, upslope of the riparian zone. This species has not been recorded in the vicinity of the other aquatic monitoring sites along the Eastern Tributary discussed in this report.

4. What are the potential impacts on the lifecycle of the potential threatened species?

Potential impacts on the lifecycle of individuals of the threatened species include dieback and death of any individuals located within the riparian zone as a result of water ponding and inundation, or as a result of reductions in pool water levels.

As *Pultenaea aristata* and *Leucopogon exolasius* are not known to occur in the areas affected, no impacts on the lifecycle of these species are expected to occur, or to place the local viable populations at risk of extinction. Suitable habitat for *Pultenaea aristata* and *Leucopogon exolasius* is not present within the area impacted (**Section** Error! Reference source not found.).

5. What are the potential impacts on the habitat of the potential threatened species?

Potential impacts on the habitat of the threatened species include bank inundation, vegetation dieback, bank scouring/sediment loss, and sediment deposition causing impacts to potential habitat.

Potential habitat for *Astrotricha crassifolia*, *Pultenaea aristata* and *Leucopogon exolasius* is not present in the areas of riparian vegetation that have been impacted by subsidence on the Waratah Rivulet. Potential habitat for *Astrotricha crassifolia* and *Pultenaea aristata* on the Eastern Tributary (refer **Section 2**) can interface with riparian vegetation but from the current site inspection, the main impacts to habitat have resulted from high water flows and physical damage from the movement of woody debris.

6. Has the habitat connectivity of the threatened species been affected?

The habitat connectivity has not been affected, nor has become fragmented for *Astrotricha crassifolia* and *Pultenaea aristata* along the Eastern Tributary as a result of mine subsidence impacts. Suitable habitat is found adjacent and upslope of the riparian areas for both these species and is present elsewhere within the Project Area and will not be subject to fragmentation.

Leucopogon exolasius has not been recorded along Waratah Rivulet or the Eastern Tributary. This species is only known from individuals recorded downstream of all riparian monitoring sites along the Eastern Tributary where more suitable habitat is present (Bangalay Botanical Services 2008).

Populations of *Pultenaea aristata* located on slopes adjacent to ET1-1 have not been impacted by the changes in stream water levels. Habitat connectivity for the *Pultenaea aristata* has not been affected and is unlikely to be affected in the future by subsidence impacts to the Eastern Tributary. Extensive flora surveys for the Metropolitan Coal Project (Bangalay Botanical Surveys, 2008) and long-term observations of this species through the vegetation monitoring program (Eco Logical Australia, various dates) has shown that *Pultenaea aristata* is widespread and common in the Project Area and surrounds.

7. What actions, if any, are most appropriate to mitigate the impacts and/or to minimise future impacts?

No detrimental impacts on the *Astrotricha crassifolia*, *Pultenaea aristata* and *Leucopogon exolasius* have occurred and are considered unlikely to occur in the future along Waratah Rivulet or the Eastern Tributary as a result of the subsidence impacts recorded to date.

5 Conclusions

Based on the assessments detailed in **Section 4**, the biodiversity impact performance measure '*Negligible impact on threatened species*', has not been exceeded as a result of subsidence impacts on aquatic ecology along Waratah Rivulet and Eastern Tributary.

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